IMPROVED FOOD DISTRIBUTION FACILITIES FOR DALLAS, TEXAS

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This study was conducted under the general supervision of Kenneth H. Brasfield, Chief, Food Distribution Research Laboratory, Agricultural Marketing Research Institute, Agricultural Research Service.

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SUMMARY

This study was undertaken in the fall of 1972 to help plan an improved wholesale food distribution center for Dallas, Tex., to replace existing facilities that may be displaced by highway or other urban renewal plans.

The 28 independent wholesalers in the study handled about 399,000 tons of food products in 1972, including fresh fruits and vegetables, groceries, and frozen foods. Most of the dealers were in the central produce district near downtown Dallas. Of the 399,000 tons, 16 percent arrived by rail and 84 percent by truck. Of the total volume handled, 40 percent was distributed by the wholesalers within and 37 percent outside the study area; 23 percent was picked up by customers at the wholesale facilities.

As a result of the inadequate facilities, there are inefficiencies in the handling of food products that can be improved. Moreover many firms will be directly or indirectly affected if various street closure, highway improvement, or other urban improvement plans are implemented.

To accommodate the wholesalers needing new facilities or those who may be affected by long-range urban improvement plans, the following buildings are suggested: Two multiple-occupancy buildings containing 16 units, 12 single-occupancy buildings, and a public refrigerated warehouse with 48,000, 282,900, and 57,600 square feet of first-floor space, respectively.

A 108-acre site would be needed for an adequate food distribution center to meet both current and potential needs. The initial building area, including streets, parking, and expansion, would require about 58 acres. Space for such facilities as a farmers' market, allied industries, and other food wholesalers who would want to locate at the market in the future would add another 50 acres.

About $9.2 million will be needed to construct the initial facilities on 58 acres of land, assuming about $15,000 per acre. A central refrigeration system capable of supplying 1,272 tons of refrigeration at peak requirements would cost about $2.1 million. Owning and operating it are estimated at $703,100 per year. The total cost of the center would be about $11.3 million.

The revenue needed to own and operate the center would be between $989,000 and $1.3 million annually, including real property taxes, costs of management and upkeep, and debt service. This would require an estimated annual payment of between $2.55 and $3.31 per square foot of building space depending on the type of financing, interest rate, and length of amortization.

The present facilities and land have market value. If sold, they could help defray the investment capital requirements for the new facilities and thereby permit rents to be lower. Local estimators place the current market value of the present facilities and land at over one-third the cost of new facilities. If this amount is used to reduce the investment capital requirements, rents would reflect a corresponding decrease of about one-third.

In addition to reducing certain handling and other marketing costs, benefits could accrue to the city, farmers, wholesalers, retailers, market employees, transportation firms, and consumers in the area. Rail and truck operations would be simplified, quality of food would be easier to maintain, sanitation problems would be reduced, the city's tax base and revenues could be increased through better use of the present sites occupied by wholesale food facilities, and the value of land used for and adjoining the new development would increase.

INTRODUCTION

This study was undertaken in the fall of 1972 at the request of the Dallas Fresh Fruit and Vegetable Association and industry representatives in cooperation with the Dallas Department of Planning and Urban Development and various economic and industrial development agencies in the city.

Part of the present central produce district in Dallas is included in plans for urban improvement (fig. 1). If these plans are implemented, they will affect most fresh fruit and vegetable wholesalers now operating in the produce district. Some highlights of the urban improvement plan include—

(1) Closing certain streets, such as Cadiz, Eureka, and Taylor.

(2) Widening Marilla Street (Taylor ext.) and extending it to Good-Latimer, with probable elimination of rail service to the present market area.

(3) Widening Harwood and other streets in the area.

(4) Creating certain green areas and setbacks adjacent to major highway and street approaches.

(5) Possibly relocating the present city-owned farmers' market.

Although most fresh fruit and vegetable wholesalers are concentrated in a market area near downtown Dallas, all fresh fruit and vegetable wholesalers operating in the city were included in the study. Firms were not included if they were predominantly a retail operation.

This study of facilities for handling fresh fruits and vegetables at wholesale in Dallas is part of a research program to improve the operations of food distributors and thus increase the efficiency of distributing fresh and processed fruits and vegetables to all consumers in the Dallas area.

Data in this report were obtained from wholesale fresh fruit and vegetable firms through personal interviews. Other data and statistics were made available by officials of city, State, and Federal Governments and various utility companies in Dallas.

ECONOMIC FACTORS AFFECTING FOOD MARKETING

Population

The Dallas metropolitan area, the 16th largest in the Nation, includes Collin, Dallas, Denton, Ellis, Kaufman, and Rockwall Counties, with 4,614 square miles of land area and over 1.5 million population. Within this area are 73 municipalities, of which 17 had populations over 10,000 in 1970. The core of the metropolitan area is the city of Dallas, with an incorporated area of 296 square miles and a 1970 population of 844,401. Dallas ranks eighth among U.S. cities. Dallas County, with a land area of 893 square miles, had a 1970 population of 1,327,321. Other Dallas County municipalities with populations of 10,000 to 97,000 include Irving, Carrollton, Richardson, Farmers Branch, Duncanville, Garland, Grand Prairie, Balch Springs, Mesquite, Lancaster, and University Park. This county had a sustained population growth exceeding that of Texas, the Southwest, and the United States. Table 1 shows the population of Dallas County subdivisions for 1960 and 1970.

TABLE 1.—*Population in Dallas County, Tex., by subdivisions, 1960 and 1970*

Subdivisions	1960 population	1970 population	Increase
	Number	*Number*	*Percent*
Dallas	717,989	881,547	22.8
Grand Prairie	32,647	48,097	47.3
Irving	48,825	99,136	103.0
Northeast	88,766	187,861	111.6
Northwest	20,212	43,672	116.1
South	23,529	43,189	83.6
Southeast	19,559	23,819	21.8
Total	951,527	1,327,321	39.5

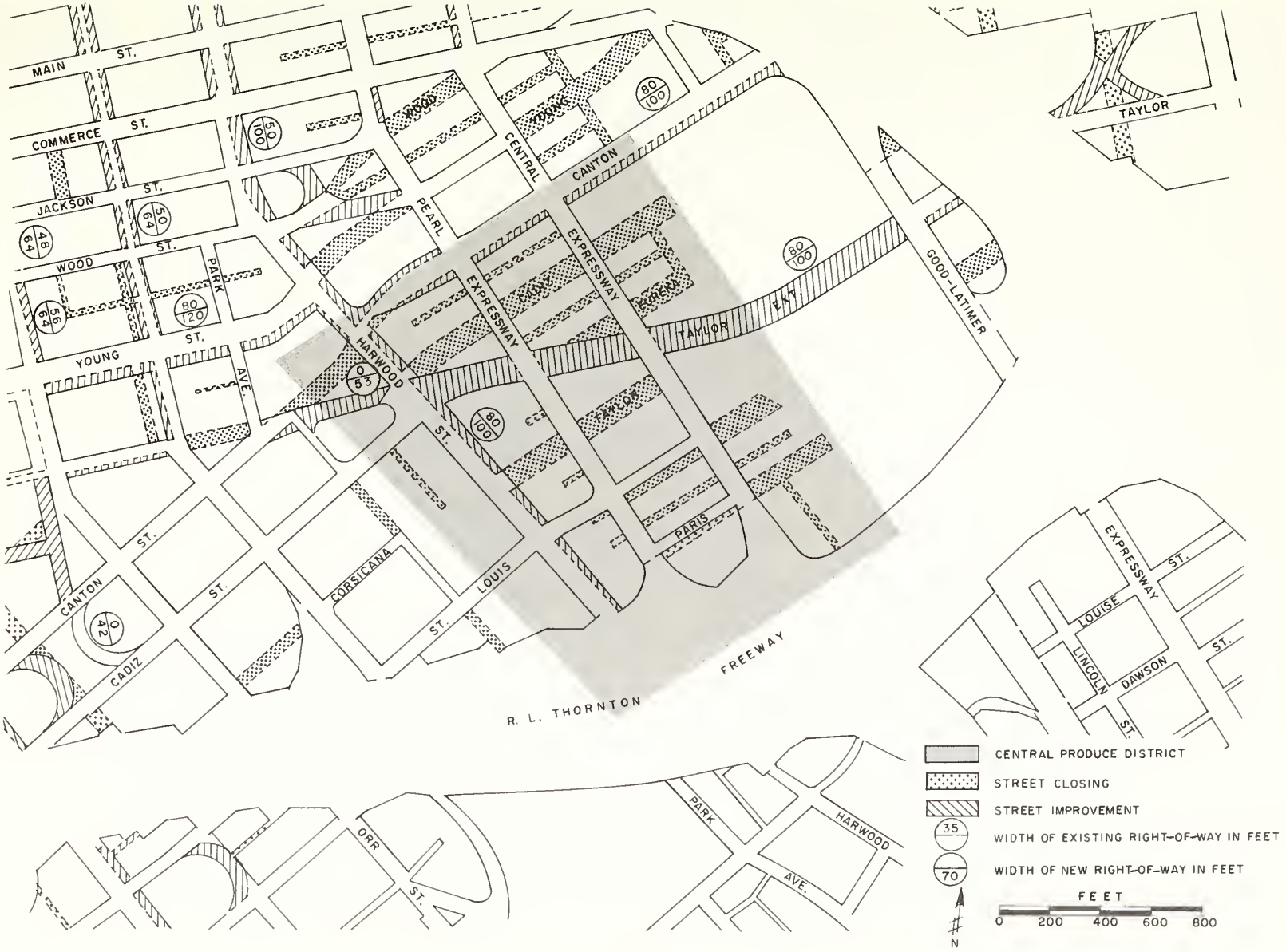

FIGURE 1.—Urban improvement plans for central produce district.

Transportation

The metropolitan area has six Interstate, four U.S., and seven State highways, two tollways, numerous county roads, and an efficient loop system. Nine rail lines serve the area, with 30 offline offices.

Nine regular and seven commuter airlines also serve Dallas. The Dallas-Fort Worth regional airport of 18,000 acres has the largest terminal in the world.

In addition, the Trinity River Barge Canal will ultimately connect Dallas with the Gulf of Mexico.

VOLUME OF RECEIPTS AND NUMBER AND TYPE OF FIRMS

The volume of fresh fruits and vegetables distributed by 28 wholesalers and processors in Dallas was estimated from information supplied by each firm. Certain combinations of commodities were broadly interpreted so as not to divulge data on individual firms. The volume of direct receipts by type of firm and commodity handled is shown in table 2.

The estimated total volume of commodities received in Dallas by the 28 independent firms was about 399,000 tons. Fresh fruits and vegetables comprised 95.2, frozen foods 3, and groceries 1.8 percent.

A firm was considered wholesale if 50 percent of the volume handled was distributed to retailers, jobbers, or other wholesalers. A firm that distributed occasionally to retail or wholesale outlets but primarily conducted a retail business was classified as retail and was therefore not included in the study.

Fresh fruit and vegetable firms were classified according to their general type of operation and services performed, as carlot receivers, commodity specialists, or wholesale jobbers. Classifications were made to categorize facility needs of individual firms and to provide a basis for recommended improvements.

Seven firms received full carlots or trucklots directly from shipping points and handled 53 percent of the total volume. They usually carried a full line of fresh fruits and vegetables. In addition, some handled groceries or frozen foods or had their own prepack and processing operation.

Six firms did some processing or prepackaging.

TABLE 2.—*Estimated volume of direct receipts by type of wholesale fresh fruit and vegetable firm and commodity handled, Dallas, Tex.*

Type of firm	Firms	Volume of direct receipts			
		Fresh fruits and vegetables	Groceries	Frozen foods	Total
	Number	*Tons*	*Tons*	*Tons*	*Tons*
Carlot receiver	7	193,709	6,550	10,450	210,709
Commodity specialist	6	47,977	---	---	47,977
Wholesale jobber	15	138,215	782	1,469	140,466
Total	28	379,901	7,332	11,919	399,152

These commodity specialists handled 12 percent of the total volume. Some of their functions were ripening, grading, and packaging consumer items.

Fifteen firms received products in less than carlot equivalents. These wholesale jobbers handled 35 percent of the total volume. They usually carried less than a full line of fresh fruits and vegetables. Some handled groceries or frozen foods. These firms were usually much smaller than those of the carlot receivers.

Fresh fruit and vegetable firms received over 80 percent of their merchandise direct from out-of-State sources. Of the total tonnage, 84 percent arrived by truck and 16 percent by rail (table 3).

The seven carlot firms received most of the incoming rail shipments. Carlot receivers and wholesale jobbers handled an almost equal amount of truck receipts, whereas commodity specialists handled about half as much as either of the other two groups.

TABLE 3.—*Estimated volume of direct receipts by type of wholesale fresh fruit and vegetable firm and transportation method, Dallas, Tex.*

Type of firm	Firms	Volume of direct receipts[1]		
		Rail	Truck	Total
	Number	*Tons*	*Tons*	*Tons*
Carlot receiver	7	64,019	146,690	210,709
Commodity specialist	6	---	47,977	47,977
Wholesale jobber	15	1,594	138,872	140,466
Total	28	65,613	333,539	399,152

[1] Includes groceries and frozen foods by fresh fruit and vegetable wholesalers; volume of air receipts reported by firms was negligible.

LOCATION, OWNERSHIP, AND SPACE UTILIZATION

The 28 wholesale fresh fruit and vegetable firms occupy more than one building in the central produce district (fig. 2). Some buildings consist of adjoining structures that have been combined into a single facility. The central produce district is bounded on the north by Canton Street, on the south by Paris Street, on the east generally by the Central Expressway, and on the west by Harwood Street. Almost 65 percent of the total building space in the market represents wholesaler-owned facilities, about 25 percent was under some type of lease arrangement, and about 10 percent was rented without formal lease agreements (table 4). Carlot receivers occupied 59, wholesale jobbers 25, and commodity specialists 16 percent of the space.

The total area for the 28 firms was almost 407,000 square feet, of which 78 percent was first-floor space. The other floors were usually for offices or general storage; however, there were exceptions when other than the first floor was used for operating space.

Over 60 percent of the total space occupied by the fresh fruit and vegetable wholesalers was unrefrigerated, almost 35 percent was for coolers and freezers, and 5 percent was for offices (table 5). Each firm averaged slightly over 14,500 square feet, of which about 4,800 square feet were refrigerated.

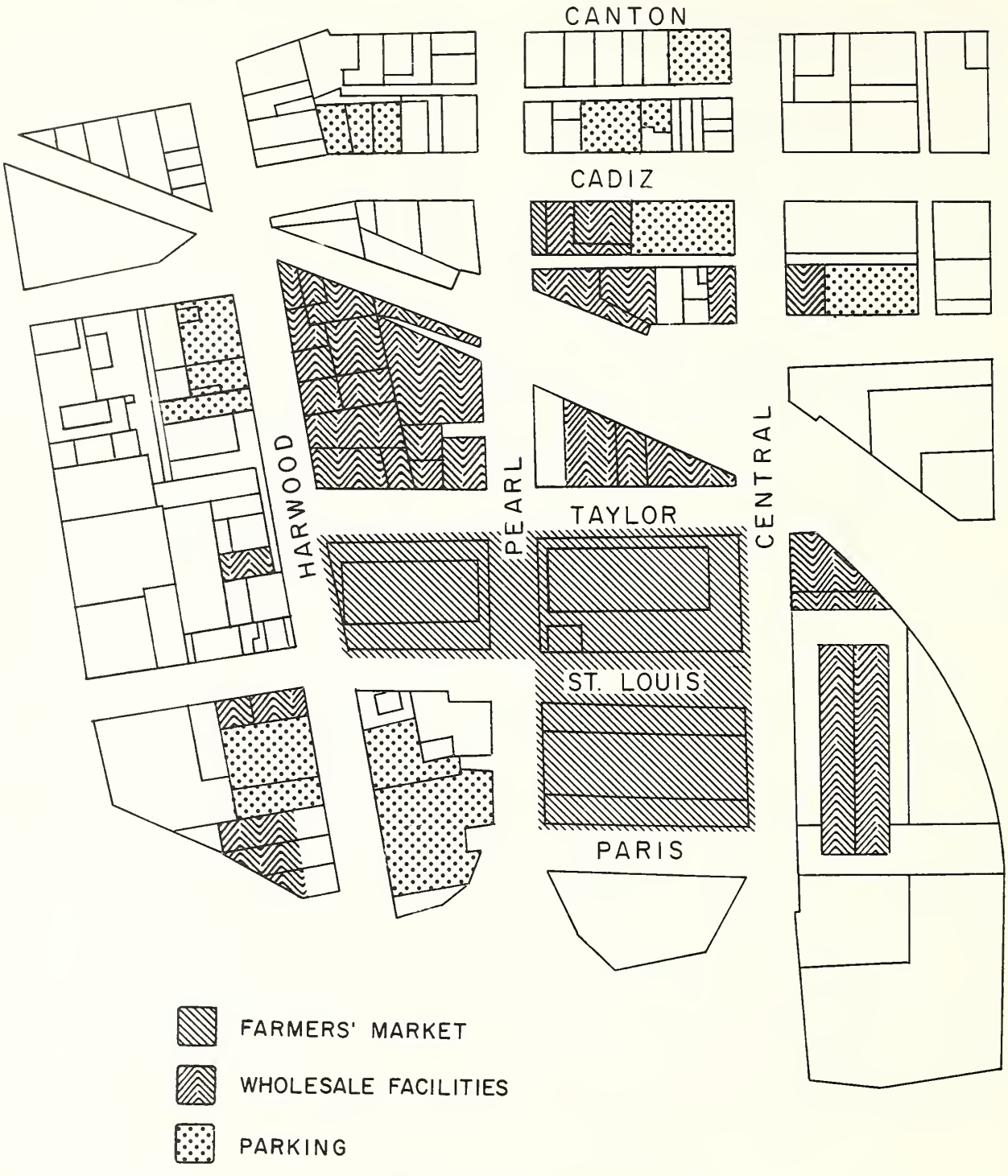

FIGURE 2.—Central produce district, Dallas, Tex.

TABLE 4.—*Facilities and estimated space occupied by type of wholesale fresh fruit and vegetable firm and tenure status, Dallas, Tex.*

Type of firm	Facilities occupied				Space occupied				Proportion of space occupied			
	Rent	Own	Lease	Total	Rent	Own	Lease	Total	Rent	Own	Lease	Total
	Number	*Number*	*Number*	*Number*	*Sq ft*	*Sq ft*	*Sq ft*	*Sq ft*	*Percent*	*Percent*	*Percent*	*Percent*
Carlot receiver	2	5	2	9	20,800	171,200	47,388	239,388	5.1	42.1	11.7	58.9
Commodity specialist	3	3	2	8	12,751	41,000	13,000	66,751	3.1	10.1	3.2	16.4
Wholesale jobber	6	5	5	16	13,568	43,450	43,600	100,618	3.3	10.7	10.7	24.7
Total	11	13	9	33	47,119	255,650	103,988	406,757	11.5	62.9	25.6	100.0

TABLE 5.—*Utilization of space by type of wholesale fresh fruit and vegetable firm, Dallas, Tex.*

Type of firm	Unrefrigerated	Cooler	Freezer	Office	Total
	Sq ft	*Sq ft*	*Sq ft*	*Sq ft*	*Sq ft*
Carlot receiver	139,571	70,148	15,747	13,922	239,388
Commodity specialist	50,872	13,743	336	1,800	66,751
Wholesale jobber	58,995	31,608	2,750	7,265	100,618
Total	249,438	115,499	18,833	22,987	406,757

SOURCE OF SUPPLY

Fresh fruit and vegetable firms received about 80 percent of their merchandise direct from outside the State, 17 percent from outside the metropolitan area but within the State, and 3 percent from within the metropolitan area (table 6).

The source of groceries and frozen foods handled by the fresh fruit and vegetable wholesalers varied as follows:

	Metropolitan area		*Outside metropolitan area but within State*		*Outside State*	
	Tons	*Percent*	*Tons*	*Percent*	*Tons*	*Percent*
Groceries	962	13	635	9	6,000	78
Frozen foods	---	4	---	9	10,000	87

TABLE 6.—*Source of supply by type of wholesale fresh fruit and vegetable firm and geographical area, Dallas, Tex.*

Type of firm	Metropolitan area	Outside metropolitan area but within State	Outside State	Total
	Tons	*Tons*	*Tons*	*Tons*
Carlot receiver	4,214	35,821	170,674	210,709
Commodity specialist	960	3,838	43,179	47,977
Wholesale jobber	5,618	26,689	108,159	140,466
Total	10,792	66,348	322,012	399,152

DISTRIBUTION OF PRODUCTS

Almost 75 percent of the total volume handled was delivered by the wholesalers, over half of which was by carlot receivers. The remaining 25 percent was either picked up by the customers or delivered by cartage firms (table 7).

Most fresh fruits and vegetables were distributed within the State. Of the total volume of direct receipts, 55 percent or almost 220,000 tons were distributed within the metropolitan area, 35 percent outside the metropolitan area but within the State, and about 10 percent outside the State (table 8).

Of the volume delivered within the metropolitan area, 62 percent was to the central area encompassed by the Lyndon B. Johnson Freeway (area 1), 21 percent to the northwest section (area 3), 10 percent to the northeast (area 2), 7 percent to the southwest (area 4), and less than 1 percent to the southeast (area 5) (fig. 3).

TABLE 7.—*Method of distribution by type of wholesale fresh fruit and vegetable firm, Dallas, Tex.*

Type of firm	Delivered by wholesalers		Picked up by customers		Delivered by cartage firms		Total	
	Tons	*Percent*	*Tons*	*Percent*	*Tons*	*Percent*	*Tons*	*Percent*
Carlot receiver	179,071	44.9	31,638	7.9	---	---	210,709	52.8
Commodity specialist	12,555	3.1	21,268	5.3	14,154	3.6	47,977	12.0
Wholesale jobber	102,698	25.7	37,768	9.5	---	---	140,466	35.2
Total	294,324	73.7	90,674	22.7	14,154	3.6	399,152	100.0

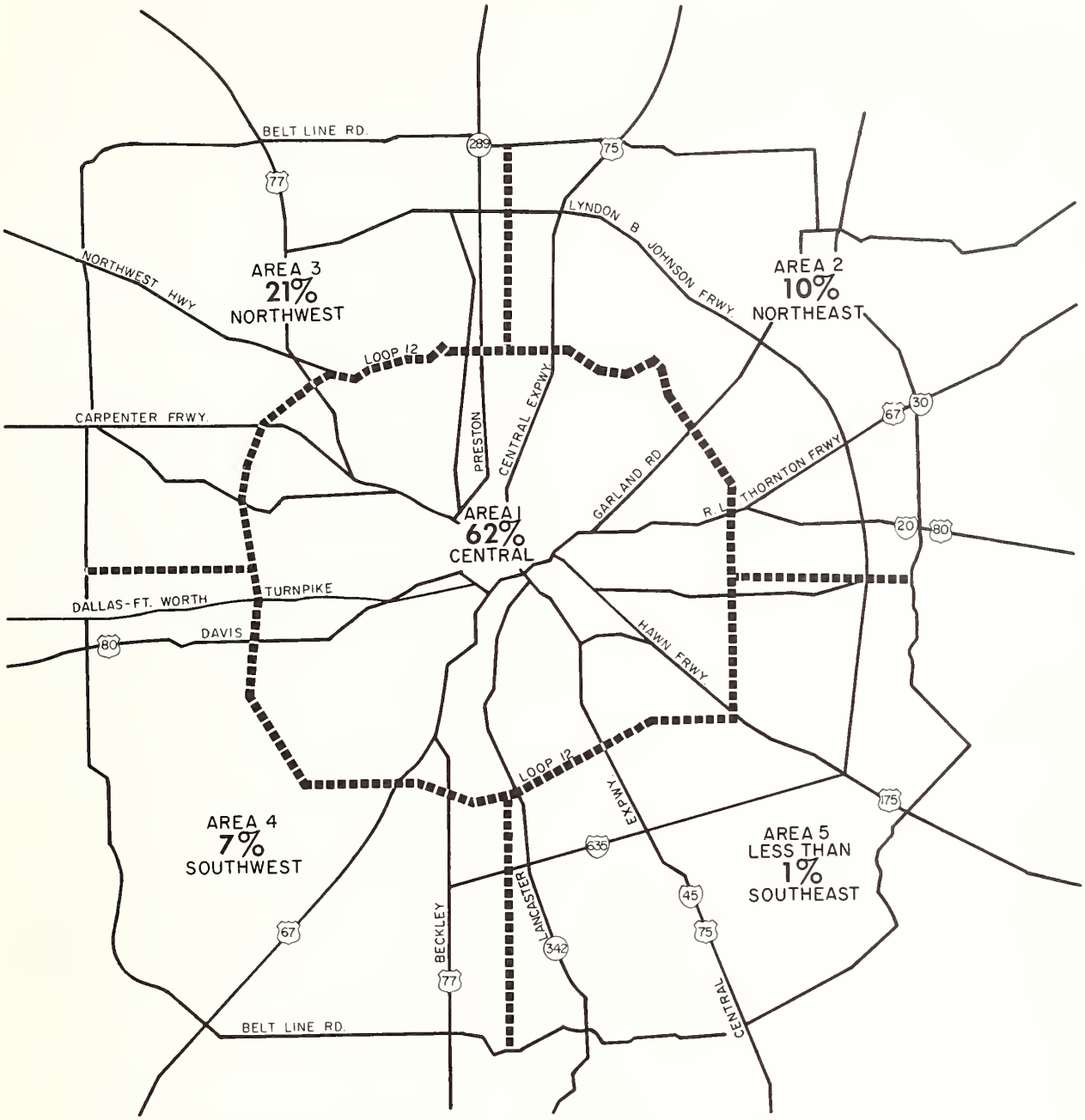

FIGURE 3.—Distribution of products within Dallas metropolitan area.

TABLE 8.—*Distribution by type of wholesale fresh fruit and vegetable firm and geographical area, Dallas, Tex.*[1]

Type of firm	Metropolitan area	Outside metropolitan area but within State	Outside State	Total
	Tons	*Tons*	*Tons*	*Tons*
Carlot receiver	90,605	103,248	16,856	210,709
Commodity specialist	19,191	12,953	15,833	47,977
Wholesale jobber	109,563	25,284	5,619	140,466
Total	219,359	141,485	38,308	399,152

[1] Includes 90,674 tons picked up by customers at wholesale facility.

NEED FOR NEW FACILITIES

Although most fresh fruit and vegetable wholesalers are concentrated near the downtown business district, some have already planned to move because their present facilities are inadequate. Many firms in the market have spent considerable money to improve and modernize their facilities but with limited success. Some are in buildings not suited to their food-handling operations. A few are in multistory buildings (fig. 4).

PN–4317

FIGURE 4.—Multistory fresh fruit and vegetable warehouse.

Some of the produce buildings are only partly suitable for modern wholesale operations. Firms in antiquated buildings have difficulty using modern materials-handling equipment. Basements must often be used for product storage (fig. 5). The confined space limits the use of pallets to keep produce off damp floors. In addition, products stored in basements must be moved from floor to floor by slow elevator or rehandled over a conveyor system. Low ceilings on the upper floors limit the use of modern storage aids, such as racks for loaded pallets stacked two high (fig. 6). Still lower ceilings limit storage to handstacking on the floor and handling equipment to four-wheel handtrucks (fig. 7).

Some firms are hampered by a lack of space outside their facilities. A few companies have no platforms for receiving and shipping and no place to build them. Other firms have no land to expand their storage areas and may have no other choice but to move.

Although the location of the present market provides excellent highway access (fig. 8), the regular business activities of some firms are restricted because of traffic congestion on the Central and Pearl Expressways. Certain firms lack adequate parking space and must obstruct traffic on city streets in order to conduct business.

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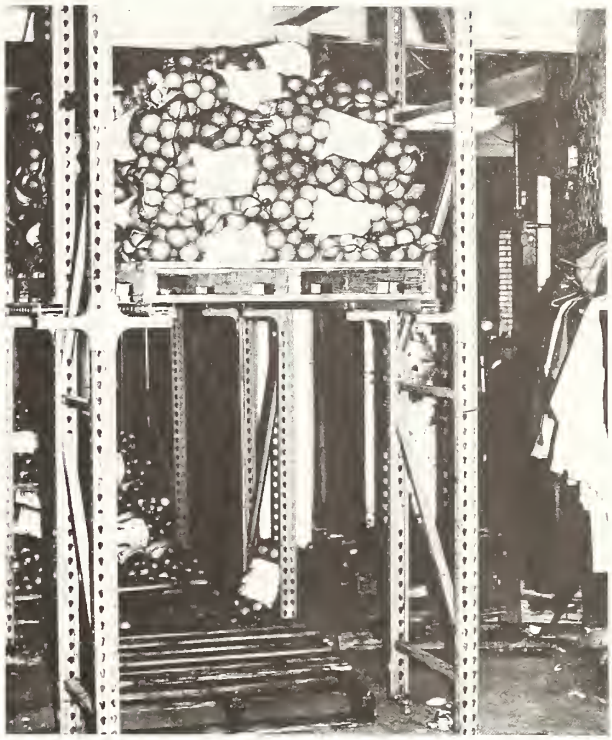
FIGURE 5.—Basement utilized for product storage.



PN–4319

FIGURE 6.—Palletized produce on racks.

PN–4320

FIGURE 7.—Low ceiling storage area.

PN-4321

FIGURE 8.—Present market location showing highway access.

BUILDING NEW FACILITIES

To meet the needs of food wholesalers expecting to locate in new facilities, two types of buildings are proposed—multiple-occupancy buildings for small-volume wholesalers and single-occupancy buildings for large-volume wholesalers.

The multiple-occupancy building would consist of a row of individual units, each 30 feet wide and 100 feet deep. Each unit would be totally enclosed without open platforms, and the interior would be designed to meet the needs of individual firms. Removable, waterproof partitions are recommended between units to allow for future expansion or for consolidation of building space if a firm needs more space than is available in a single unit.

The single-occupancy building is for use by one firm and would be designed for that firm. The amount of floorspace in each building would depend on the needs of the firm that will occupy it. The kind and volume of products handled and the extent and nature of processing to be done are factors each firm would consider in determining its floorspace requirements. The only requirement that should restrict the planning of single-occupancy buildings is that they should be compatible with an overall master plan for all the facilities in the development.

Functional buildings consistent with local building codes and users' specifications should be constructed to hold down costs.

Twenty-six wholesalers [1] in the Dallas area have been included in plans for the new center. The facilities needed for these firms could be summarized as follows:

(1) Two multiple-occupancy buildings containing 48,000 square feet of first-floor space.

(2) Twelve single-occupancy buildings containing 282,900 square feet of first-floor space.

(3) A public refrigerated warehouse containing 57,600 square feet of first-floor space.

(4) A central refrigeration plant.

(5) Direct rail access.

(6) Paved streets and parking areas with adequate maneuvering space for trucks.

(7) Space for expansion of present facilities and for construction of additional facilities for food distribution or allied industries.

[1] Two firms operating in more than one facility anticipated combining their operations in new facilities.

Table 9 shows the space and building requirements for the carlot receivers, commodity specialists, and wholesale jobbers. They would need 53, 20, and 27 percent, respectively, of the 330,900 square feet of proposed space.

The proposed facilities are shown arranged as a food distribution center in figure 9. This arrangement may have to be adjusted to meet the limitations of specific sites. The different parts of the proposed center have been arranged to complement each other and avoid interference between different operations. The single-occupancy buildings are located along common or shared streets, and each street has direct or adjacent access to a market entrance. All the multiple-occupancy buildings are located together so that the traffic generated by buyers coming to these facilities will not interfere with the operations of other firms. The farmers' market is isolated from the rest of the center to avoid placing the burden of retail traffic using its facilities on main market streets. However, firms at the farmers' market will have convenient access to their suppliers in the center. The public refrigerated warehouse is well located to serve the center. A central energy plant adjoins the public refrigerated warehouse. Figure 10 shows an artist's conception of the proposed distribution center on an ideal site.

Multiple-Occupancy Buildings

Two multiple-occupancy buildings with 48,000 square feet of first-floor space and 16 units are recommended to meet the needs of smaller firms.

Figure 11 shows a section view of a multiple-occupancy building of the type proposed for the Dallas wholesale food distribution center. Floor-to-ceiling and wall-to-wall partitions will separate the different firms. These partitions should be removable to permit future space adjustment among the firms. A mezzanine 30 feet wide and 20 feet deep extends out to form a canopy 16½ feet above the pavement. One end of each unit is designed to serve refrigerated railcars and the other end to service trucks. The floors are 55 and 45 inches, respectively, above the pavement.

Figure 12 illustrates the floor plan of a unit in the multiple-occupancy building arranged to serve a typical small fruit and vegetable wholesaler. Each unit contains 3,000 square feet of first-floor space and 600 square feet of mezzanine floorspace. The cooler ceiling should be constructed to the full height of the unit to permit the use of pallet racks and pallets in the storage of refrigerated products. A door seal at the rear and double-acting doors at the front of the cooler would reduce refrigeration loss when products are brought into and out of the room. Products can be received and shipped at either end of the unit. However, to maximize control and minimize supervision required, the rear of the unit could be limited to rail receipts and emergency operations and all other receiving and shipping operations could be performed at the front.

Figure 13 shows pallet racks used extensively throughout much of the first floor to promote efficient use of the available cubic space in the facility. These racks are designed for 40-inch-deep and 48-inch-wide pallets and arranged to store four to five levels of produce. Narrow aisle forklift trucks would be utilized in this handling system.

TABLE 9.—*Type of firm, volume handled, present space, and building and space recommendations for improved wholesale fresh fruit and vegetable distribution center, Dallas, Tex.*

Type of firm	Annual volume [1]	Proposed facilities					First-floor space	
		Multiple occupancy			Single occupancy		Present	Proposed
		Buildings	Units	First-floor space	Buildings	First-floor space		
	Tons	*Number*	*Number*	*Sq ft*	*Number*	*Sq ft*	*Sq ft*	*Sq ft*
Carlot receiver	210,709	0	0	0	6	173,900	239,388	173,900
Commodity specialist	47,977	2	7	21,000	2	45,200	66,751	66,200
Wholesale jobber	140,466		9	27,000	4	63,800	100,618	90,800
Total	399,152	2	16	48,000	12	282,900	406,757	[2] 330,900

[1] Includes direct receipts of groceries and frozen foods handled by fresh fruit and vegetable wholesalers.

[2] Does not include 57,600 sq ft for public refrigerated warehouse.

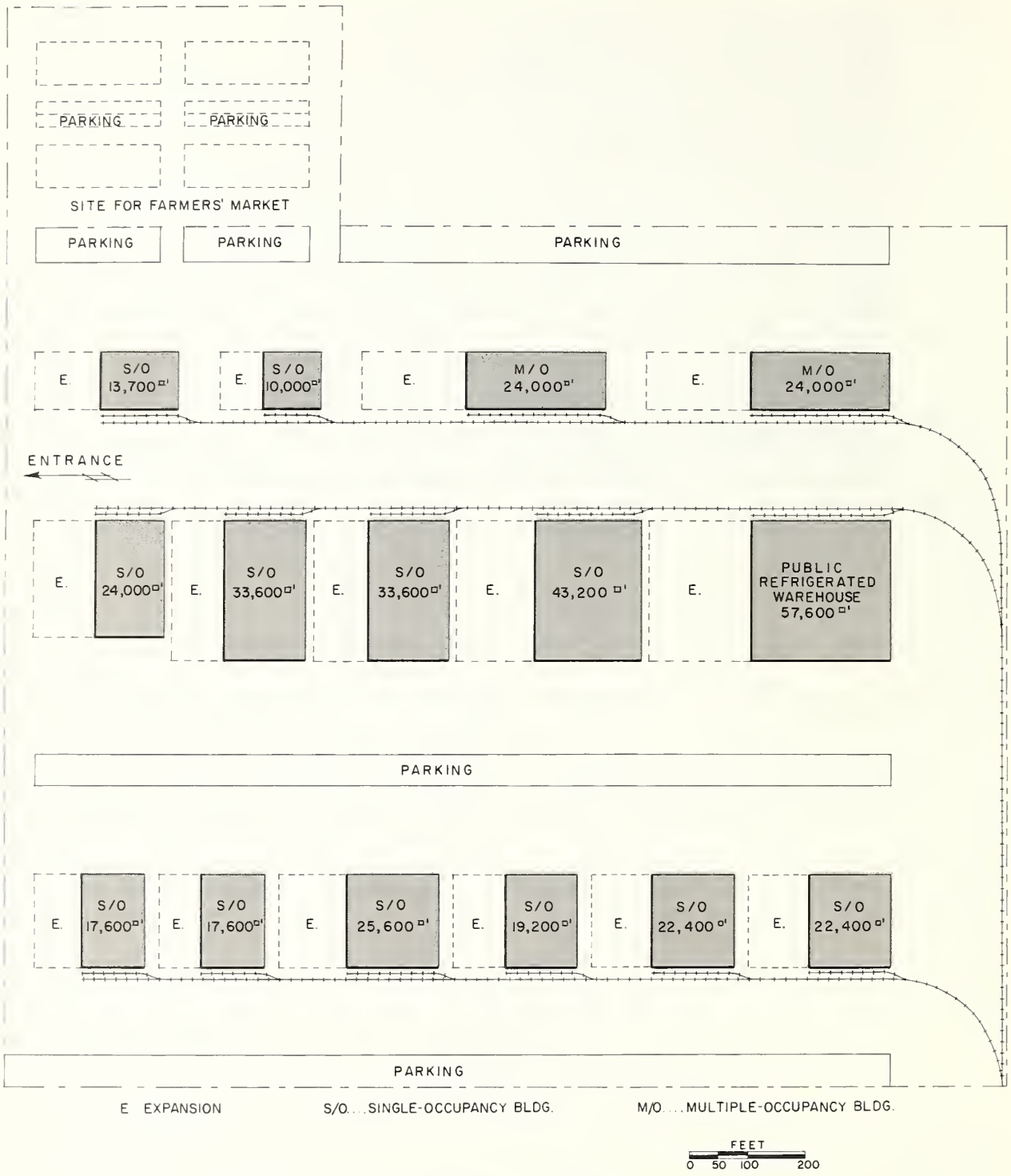


FIGURE 9.—Master plan for proposed Dallas food distribution center.

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FIGURE 10.—Artist's conception of proposed Dallas food distribution center.

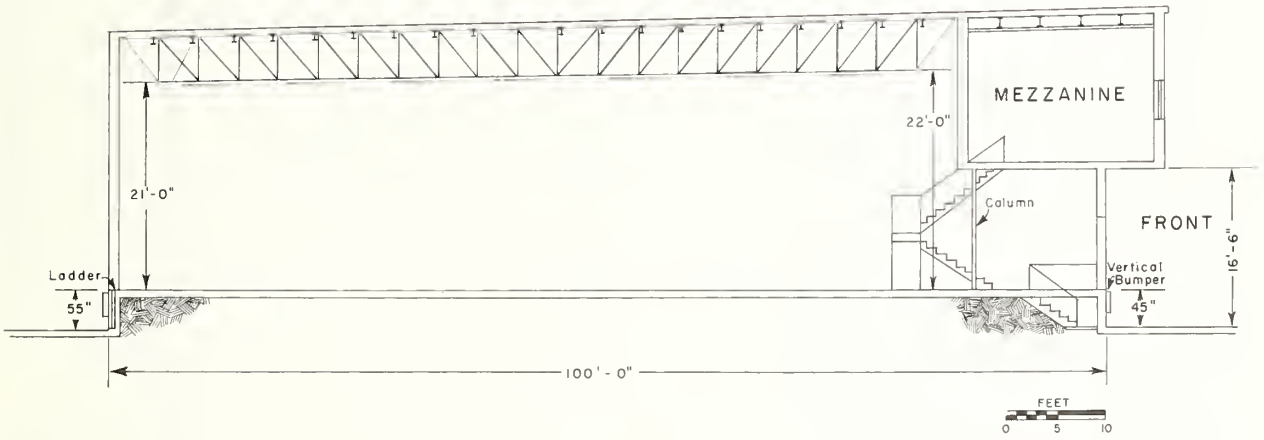

FIGURE 11.—Section view of a multiple-occupancy building.

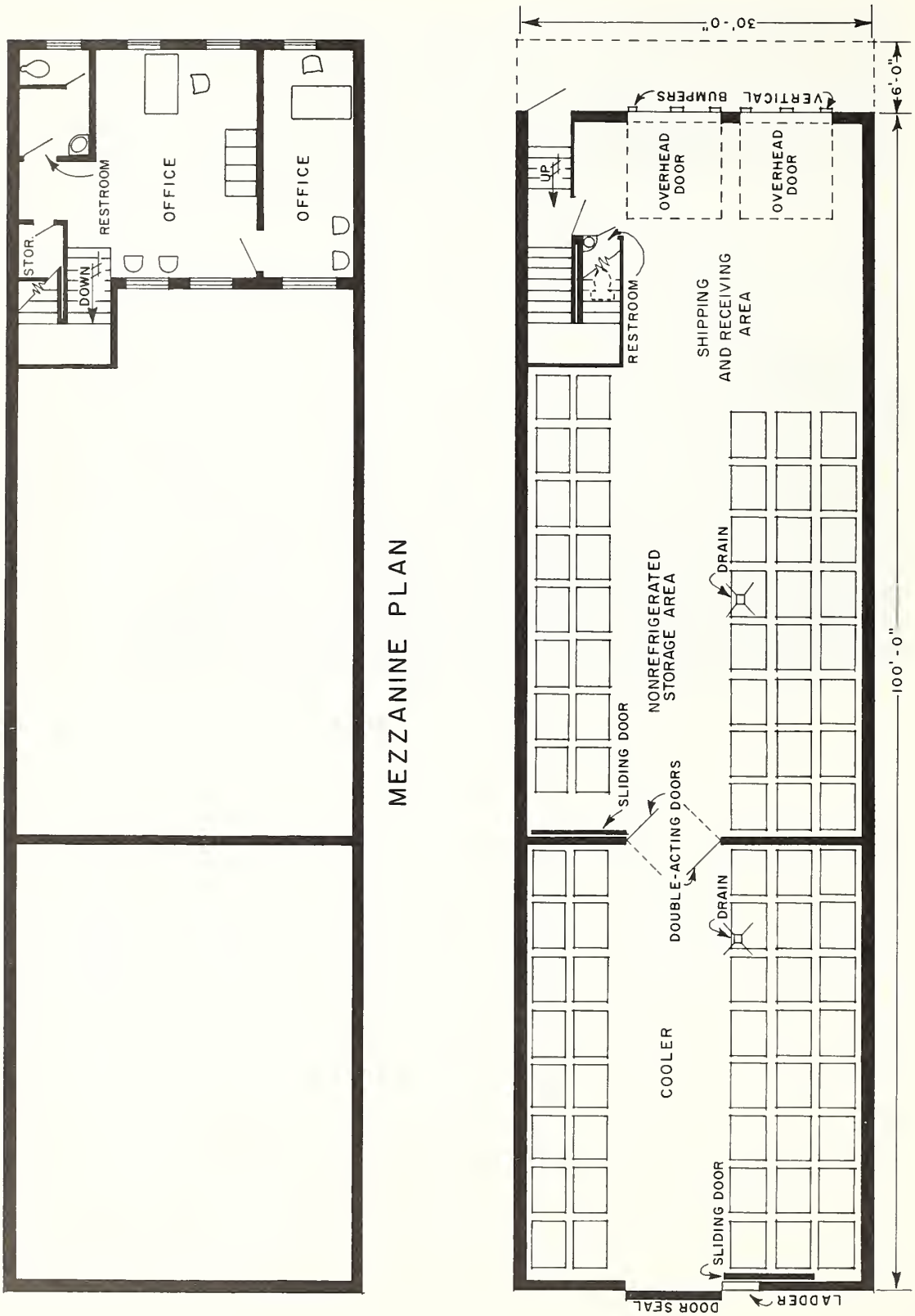

FIGURE 12.—Layout for a fresh fruit and vegetable firm in a multiple-occupancy building unit.

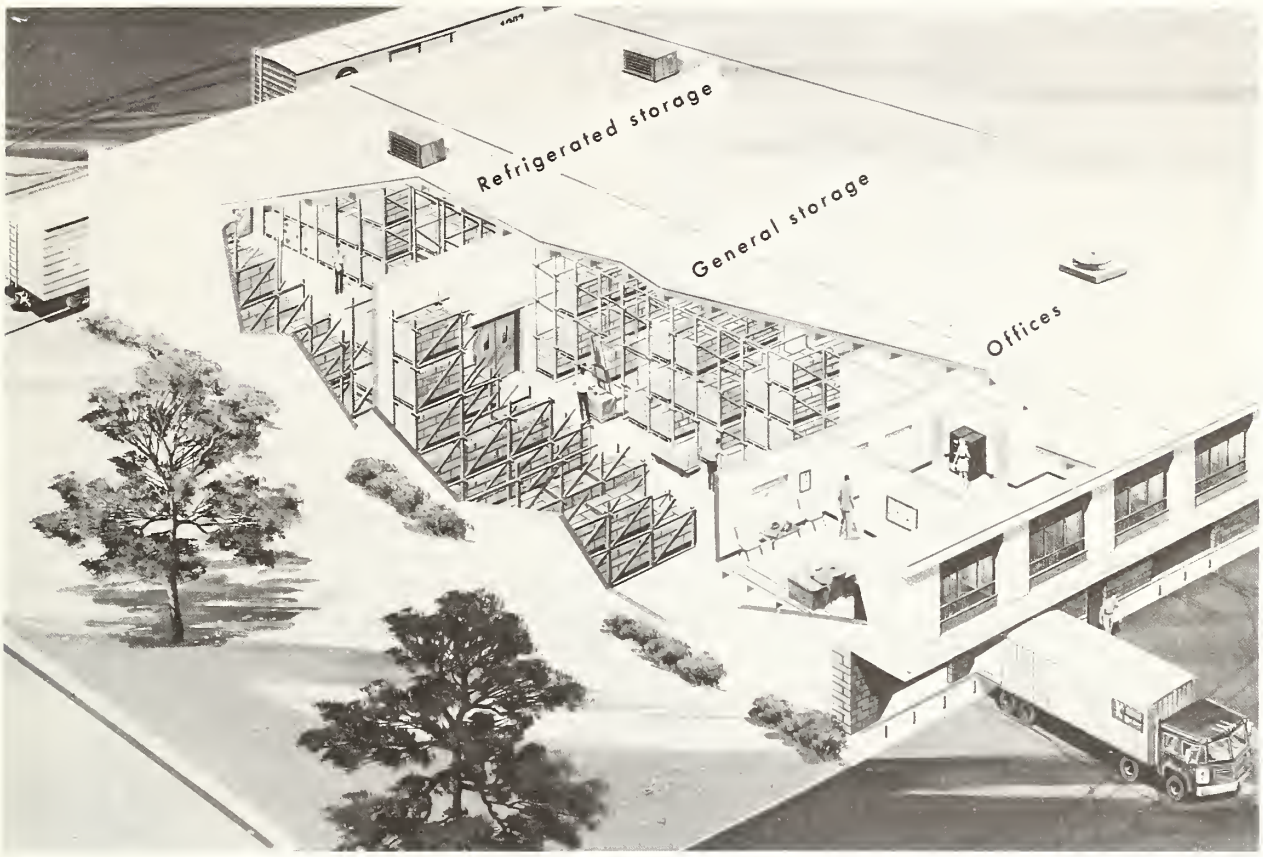

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FIGURE 13.—Artist's conception of a multiple-occupancy building unit, showing arrangement of pallet racks.

Offices and restrooms are located on the mezzanine. This arrangement allows valuable first-floor space to be used directly for product-handling activities. The space below the mezzanine is for receiving and shipping operations, functions not requiring a high ceiling. A restroom is on the first floor for the convenience of employees. Stairs are arranged to facilitate movement between the first floor, mezzanine, and street while allowing access between the first floor and the mezzanine to be secured.

Single-Occupancy Buildings

Twelve single-occupancy buildings, totaling 282,900 square feet of first-floor space, are required to meet the needs of the larger produce wholesalers. The layout in figure 14 is representative for a fruit and vegetable wholesale firm conducting limited prepackaging and ripening operations in addition to its conventional warehousing operations. This single-occupancy building, with 25,600 square feet of first-floor space, would be suitable for a company with $3.8 million in annual sales. Figure 14 is not intended to represent a facility for a particular firm in this study.

In many of the warehouses in the present market, most of the produce is moved by handtrucks, manual pallet jacks, and clamp trucks. As a result, only a limited amount of produce can be handled at one time, and it is moved slowly. However, in the proposed facilities, forklift trucks can be used to move much of the produce to and from storage. Larger quantities can be moved at one time, increasing labor productivity and reducing the damage from excessive handling. Pallet racks, as utilized in figure 13, make possible the efficient use of cubic space available in these facilities and help protect products from damage.

The recommended facilities are single-floor buildings. An open, single-floor design can promote quick and efficient movement of large quan-

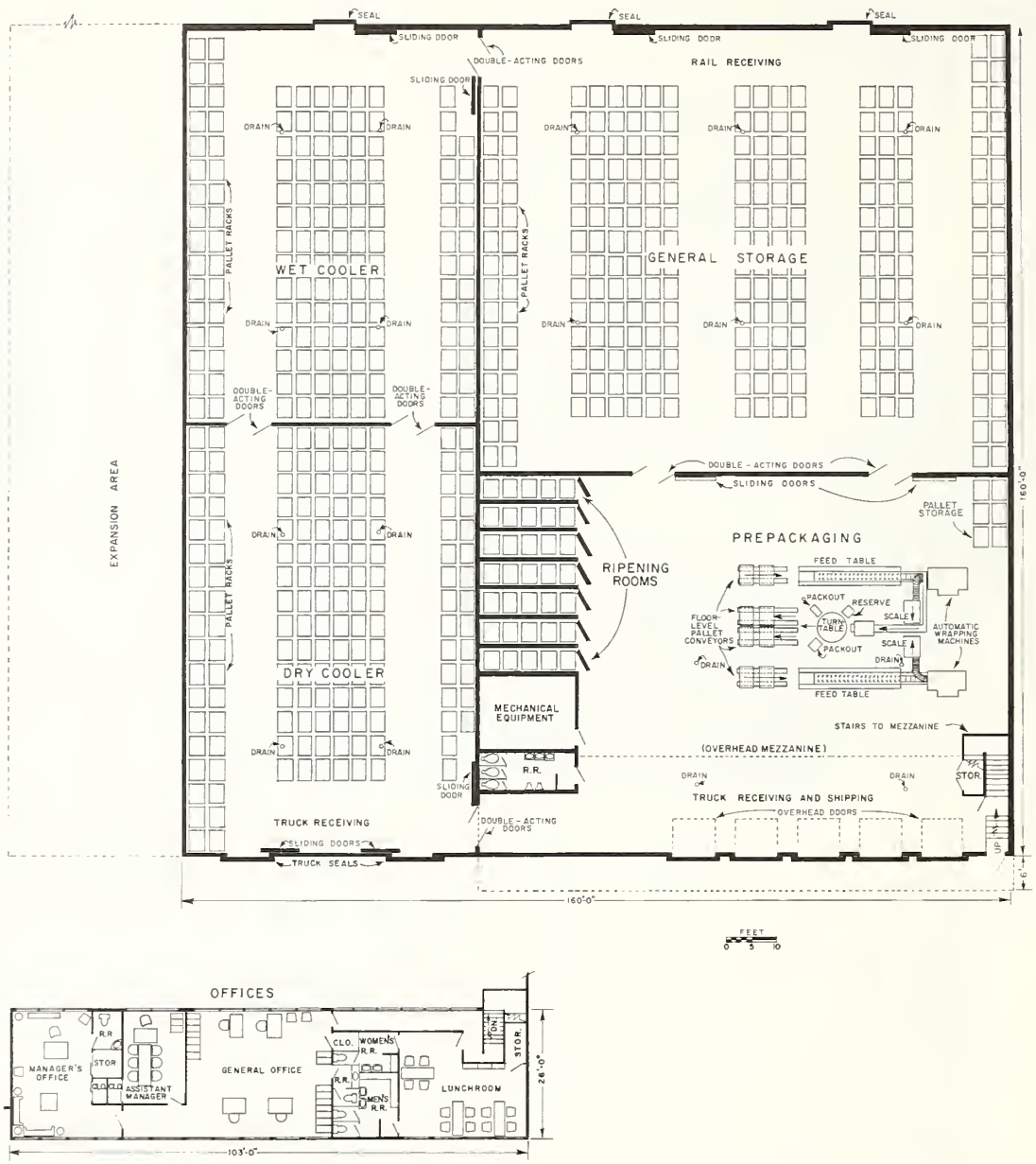

FIGURE 14.—Layout for a fresh fruit and vegetable firm in a single-occupancy building.

tities of products into, within, and out of the facilities. Equivalent operations in multistory buildings are often delayed by long waits for elevators and are frequently hampered because of internal building structures, which are necessary to support the upper floors. Double handling of products is almost always required when moving products from one floor to another by conveyor.

The interior of the building is arranged for efficient use. The wet cooler, dry cooler, and general storage areas have direct access to the outside of the building (fig. 14) to facilitate receiving and shipping operations. Their locations allow quick and efficient movement from one area to another.

Offices, a lunchroom, and restrooms are on the mezzanine. This arrangement leaves first-floor space free for product-handling activities. The

mezzanine is over the truck receiving and shipping area, which does not require a high ceiling.

Public Refrigerated Warehouse

A one-story public refrigerated warehouse with 57,600 square feet of first-floor space has been included in the proposed center. The interior as well as the amount of cooler and freezer space would be developed by the tenant. The facility should have the capability of storing products at specific temperatures under controlled humidity. It could be used to store perishable food for producers, wholesalers, retailers, brokers, consumers, or others in any quantity up to thousands of packages.

It could reduce the necessity for individual wholesale distributors to own and maintain excessive amounts of unused refrigerator capacity during low demand periods and yet would allow them to meet consumer needs during peak demand periods.

Farmers' Market

Often the terms "municipal market," "public market," and "farmers' market" are used interchangeably. In many ways they are alike, especially when fresh farm products are offered for sale to both wholesale and retail buyers. One of the most important criteria in determining what constitutes a farmers' produce market has been whether farmers themselves sell their own fruits and vegetables individually. This criterion was used in this report.

A section reserved for a farmers' market has been included in the master plan. No separate cost allocation has been made until the definite relocation of the existing farmers' market is determined.

Central Refrigeration System

A central refrigeration system is provided in the plan. The system consists primarily of a central plant and a network of pipelines to the users. The central plant should be capable of supplying 1,272 tons of refrigeration at peak loads. This requires a building with approximately 9,800 square feet of floorspace and an outdoor area of 6,000 square feet to accommodate the necessary equipment and service functions. In addition, another 10,000 square feet of land is provided for future expansion. This system would supply not only refrigeration but also air-conditioning and heat to proposed facilities. The refrigerant would be distributed from the central plant through a network of underground pipes to individual coolers and freezers throughout the food distribution center. Air-conditioning and heat would be provided through the same system by utilizing the heat exchangers, heated or cooled tapwater, and air-conditioning units. An individual wholesaler would pay only for the amount of refrigeration he used.

A separate study was conducted to determine the requirements and costs for a central refrigeration system for the proposed market. A recommended plant is described in a previous report.[2]

Streets and Parking Areas

Wide streets provide space for large trucks to maneuver and park perpendicular to the platforms on both sides of the buildings. Cross streets facilitate efficient traffic flow to the various sections of the market.

All streets in the food center should be paved to carry heavy traffic. Drainage should be away from the buildings to drains in the streets. Paving could be of a blacktop combination, which would consist of a foundation of 7 inches of gravel or crushed rock, 4 inches of macadam base, and 2 inches of asphaltic concrete surface. Concrete paving 6 inches thick is suggested for areas where oil or gasoline drippings would be so excessive as to soften or dissolve the asphalt.

Parking areas should be considered an integral part of the center and have space for expansion.

Rail Connections to Buildings

Direct rail service has been planned to all market buildings and can be extended as the market expands. Individual switches will permit service to each building without interference to other buildings in the market.

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[2] Food Industry Services. central refrigeration system for a proposed food distribution center in dallas, texas. U.S. Dept. Agr. ARS–NE–27, 24 pp., illus. 1973.

Expansion Areas

Land for future growth and expansion should be acquired at the outset. If it cannot be obtained at the time of purchase, it should be committed to market use by agreement if possible to assure that future construction will be compatible with the overall development of the market.

Solid Waste Disposal

Pending antipollution legislation in some areas of the country is limiting the choice of solid waste management systems that can be used, and it is forcing some areas to upgrade the system in use.

Many types of such systems are available. Factors to be considered when selecting a method for managing solid wastes include economic feasibility, system implementation considering the physical characteristics of a particular center, acceptability to the tenants, and present or pending antipollution regulations.

An in-depth engineering study entailing the evaluation of solid waste sources and types, waste generation rates, and present methods of waste handling and disposal at food distribution centers was conducted under contract for the Department.[3]

ACREAGE REQUIRED

The acreage required for the proposed facilities would vary depending on the shape of the site selected. About 100 acres should be obtained to develop an adequate food distribution center to meet current and potential needs. This size site would be needed for the initial center, including buildings, streets, parking, and expansion. Additional space should be available for a farmers' market, allied industries, and other food wholesalers who would want to construct facilities close to the market. The following acreage would be required for the various facilities:

Type of facility	*Acres*
Present needs:	
Single-occupancy buildings	42
Multiple-occupancy buildings	7
Public refrigerated warehouse	9
Potential needs:	
Farmers' market	5
Food-chain warehouse	25
Allied industry expansion	20
Total	108

SELECTING A SITE FOR THE PROPOSED FOOD DISTRIBUTION CENTER

Potential sites were selected from lists obtained from various utility companies, the Dallas Chamber of Commerce, wholesale food firms, real estate firms, and others in the Dallas area. The locations of sites considered representative of those available are shown in figure 15, and they are described in table 10. All meet the acreage requirements and no order of preference is intended.

Importance of Commercial Zone for Motor Freight

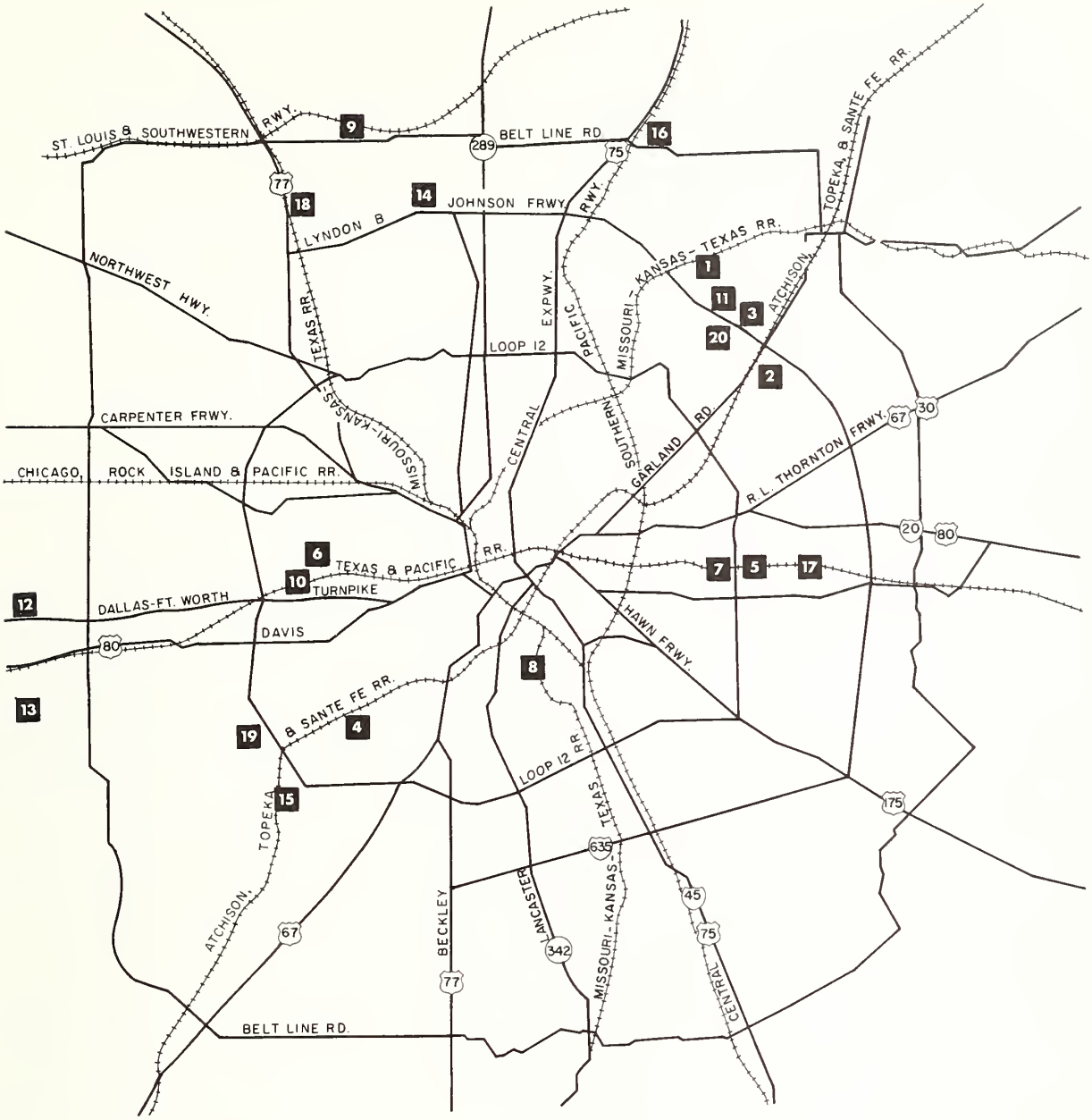
In considering a site for distribution facilities, commercial zone location provides economies of time and money.[4]

Intrastate Commerce-Dallas Commercial Zone

The Dallas commercial zone includes all the cities in Dallas and Tarrant Counties except Sachse (Dallas County) but including Plano (Collin County). A location within the Dallas

[3] Volz, M. D., and Stearns, R. P. solid waste management systems for food distribution centers. U.S. Dept. Agr. Agr. Mktg. Res. Rpt. 944, 55 pp., illus. 1974.

[4] Information from Economic Development Office, Dallas Power and Light Co.



1 MISSOURI-KANSAS-TEXAS RAILROAD	11 GARLAND
2 HAWN	12 MARK I
3 SANTE FE	13 MARK 2
4 OAK CLIFF	14 METROPOLITAN
5 BUCKNER PARK	15 RED BIRD
6 TEXAS AND PACIFIC RAILROAD	16 RICHARDSON
7 BUCKNER BLVD.	17 SKYLINE
8 CENTRAL	18 VALLEY VIEW
9 COTTON BELT	19 HODGE
10 EAGLE FORD	20 BRITTINGHAM

FIGURE 15.—Possible sites for proposed food distribution center.

TABLE 10.—*Descriptions of potential sites for proposed wholesale food distribution center in Dallas County* [1]

	Site	Access to railroads	Railroad reciprocal switching limits [2]	Access to highways	Approximate cost [3]	Approximate size	Zoning	Location from downtown Dallas
					Thousand dollars	*Acres*		
1	Missouri-Kansas-Texas Railroad.	Missouri-Kansas Texas.	Within	½ mile east of L.B.J. Frwy. and Interstate 635.	5	182	Industry 2	Northeast.
2	Hawn	Atchison, Topeka, and Santa Fe.	do	Fronts L.B.J. Frwy. and Shiloh Rd.	20	117	do	Do.
3	Sante Fe	do	do	L.B.J. Frwy.; Kingsley and Jupiter St.	17	100	Industry 1	Do.
4	Oak Cliff	do	do	Illinois and Westmoreland Ave.	17–19	117	Industry 2	Southwest.
5	Buckner Park	Texas and Pacific	Outside	Buckner Blvd., Farney Rd., Big Town Blvd.	20	187	do	East.
6	Texas and Pacific Railroad.	do	Within	Singleton Blvd.	(4)	148	do	West.
7	Buckner Blvd.	do	Outside	Buckner Blvd., Loop 12, Military Pky.	11–54	166	Light industry	East.
8	Central	Missouri-Kansas-Texas.	Within	Cedar Crest and Corinth St. Rd.	13–43	150	do	South.
9	Cotton Belt	St. Louis and Southwestern.	Outside	Belt Line Rd., U.S. 77, Preston Rd.	11–15	106	do	Northwest.
10	Eagle Ford	Texas and Pacific	Within	Singleton Blvd. and Dallas Ft. Worth Turnpike.	13–22	190	do	West.
11	Garland	Atchison, Topeka, and Sante Fe.	do	Jupiter St. and L.B.J. Frwy.	9–17	110	do	Northeast.
12	Mark 1	Chicago, Rock Island and Pacific.	Outside	Dallas-Ft. Worth Turnpike.	24–65	590	do	West.
13	Mark 2	Texas and Pacific	do	Marshall, U.S. 80, Belt Line Rd.	15–17	150	do	Do.
14	Metropolitan	St. Louis and Southwestern.	do	Dooley, L.B.J. Frwy., Dallas North Tollway.	20	326	do	Northwest.
15	Red Bird	Atchison, Topeka, and Sante Fe.	Within	Duncanville Rd., Loop 12, U.S. 77.	13–27	1,200	do	Southwest.
16	Richardson	Southern Pacific	Outside	Belt Line Rd. and Central Expressway.	17	197	do	Northeast.
17	Skyline	Texas and Pacific	do	Military Pky. and L.B.J. Frwy.	13–20	600	do	East.
18	Valley View	Missouri-Kansas-Texas.	do	U.S. 77 and 35-East	37–109	128	do	Northwest.

19 Hodge	None	Within	Duncanville and Kiest Rd.	[4]	120	---do---	Southwest.
20 Brittingham	Atchison, Topeka, and Sante Fe.	---do---	L.B.J. Frwy., Jupiter St., Northeast Hwy.	44	165	---do---	Northeast.

[1] Electricity, gas, water, and sewer available at all sites except Missouri-Kansas-Texas Railroad.

[2] Switch charge must be paid by shipper or receiver for firms not located within established switching limits. For further information, see section on "Importance of Reciprocal Switching Privileges for Rail Freight."

[3] Land costs may vary on some sites. Choice locations on a particular site may be more expensive than less choice locations on the same site.

[4] Cost not available.

commercial zone enables motor carriers to operate within this area without obtaining a certificate from the Texas Railroad Commission. There are also no rate regulations.

A location outside this zone will require the use of regulated carriers or company-owned vehicles to ship into the Dallas-Tarrant County market. The firm loses the flexibility of a negotiated rate and must rely on published rates and certified carriers to serve its customers. Only carriers certified to serve the adjacent area may serve the site outside this zone. Often shipments must be stored at a terminal for distribution and thus are delayed in reaching the Dallas-Fort Worth commercial zone customers. This delay could be prevented if the firm were within this zone.

Interstate Commerce-Dallas Commercial Zone

Cities and towns within 5 air miles of the city limits of Dallas are in this interstate zone, including Fort Worth, all Dallas County, and the cities between Dallas and Fort Worth. A location within this zone means that interstate carriers with a certificate to serve Dallas may serve any of the cities within 5 air miles of the Dallas city limits.

A location outside this zone will usually cause delays in less than truckload shipments. Most of the smaller communities have only three or four carriers certified to serve them. This means that in many instances the carrier serving the community will not have a permit to serve the final destination. This would cause the shipment to come to the Dallas terminal for transfer to another truckline and delay it from 1 to 3 days.

Importance of Reciprocal Switching Privileges for Rail Freight

In considering a site for distribution facilities, a location within rail reciprocal switching limits is important.[5] Should an industry choose a location not open to reciprocal switching, the carriers serving the firm generally require that they be included as line haul carriers on the inbound or outbound movement. In other words, a carrier must be included in the routing and actually participate in the handling of and share in the rev-

[5] See footnote 4.

enue derived from bringing the car into its destination. If the carrier does not, it must assess a switching charge, which is an addition to the line haul rate, of $45.89 per car when the delivering line performs service on 1 mile or less from its connection; $48.22 when the service is between 1 and 2 miles; and $50.99 when the service exceeds 2 miles. This switch charge must be paid by the shipper or receiver. The charges are published in item 1120, notes B and C, Supplement 90, Texas-Louisiana Freight Bureau Tariff 1-J RCT 407.

If an industry is located at a point and on a line open to reciprocal switching, any carrier of its choice that serves the destination and is a party to the rate involved may take the shipment into the destination, and the switching charges of the line serving the facility will be absorbed by the inbound line haul carrier.

There are two advantages to using this type of arrangement. (1) Because of a particular service reason, the firm might elect not to use the line that performs its switching. (2) The possibility exists that the line serving the plant might not participate in a particular rate, but other carriers serving the destination do participate. When industry is open to reciprocal switching, it may route via any carrier of its choice, perform any stops or other transit arrangements applicable in connection with the rates it is using, and the switching line serving this industry does not necessarily have to be included in the routing.

The Dallas switching limits for the site included in this report are shown in table 10.

METHODS OF FINANCING

Two or more sources of capital could be used to finance a new wholesale distribution center in the Dallas area. The entire project could be constructed and operated by a single group or agency, or various parts could be constructed and operated by different groups or agencies.

Some of the more common methods of financing food distribution centers are through private corporations, public benefit corporations, direct public ownership, or a combination of these methods. A Department publication describes each of these methods of financing and ownership in detail.[6] They are also described in the appendix under "Types of Ownership."

ESTIMATED INVESTMENT IN LAND AND FACILITIES

The basic costs of constructing a new wholesale food distribution center are for land and facilities. These costs can vary considerably depending on land costs and the time of construction.

Acquisition of a site is subject to negotiation regardless of the assessed value or appraisal of actual value. Facility costs will be about the same regardless of the site selected. The estimates in this report do not include government subsidies in any form. They include only those costs of buying the land and constructing the needed facilities. Costs are not included for additional facilities that may be built later in the expansion areas or for access streets, water mains, and sewers, which are usually supplied by the city or the municipality where the site is located. The estimates in this report are intended to be used as a guide when the market site has been selected. The total investment costs here are used as the basis for computing debt service.

Land

Many industrial areas in Dallas have adequate acreage available for the construction of the proposed food distribution facilities. Actual land costs will depend on the site selection and sale conditions. Land values were obtained from local realtors, utility companies, and other coopera-

[6] Clowes, H. G., Elliott, W. H., and Crow, W. C. WHOLESALE FOOD MARKETING FACILITIES, TYPES OF OWNERSHIP AND METHODS OF FINANCING. U.S. Dept. Agr. Agr. Mktg. Res. Rpt. 160, 96 pp., illus. 1957.

tors in this study.[7] Land costs in outlying areas will generally be lower than those nearer the city where there is considerable commercial development. In this study a land value of $0.35 per square foot or $15,400 per acre is considered representative.

Facilities

The costs of facilities are based on 1973 construction indices. Buildings are of a "light mill" type. They are generally of steel frame construction with enclosing walls of masonry. The interior walls are exposed masonry, and the ceilings are exposed structure. The floors are cement finish. Estimates include such items as general illumination and normal distribution of convenience power outlets, stairways, and restrooms. They do not include furnishings or specialized equipment.

Estimates for paved surfaces within the proposed market area have been prorated among the prospective tenants. A similar system is used to prorate share of lead-in tracks and rail switches from property boundaries to the house tracks behind each building. Other items included in the estimates are street lights, house tracks, and sewers within the property boundaries. The local municipalities' costs for highway and sewer line constructions to the market site are not included in these costs.

Construction costs in this report should be used only as a guide in estimating the total costs of the market. They are *not* intended to reflect firm estimates made by local architects and contractors.

The following tabulation shows the estimated costs of the facilities proposed for the new food distribution center. The methods used to develop these costs are described in the appendix under "Construction Costs."

ESTIMATED CONSTRUCTION COSTS

Wholesale Buildings

Single-occupancy facilities:	
Buildings (12, totaling 282,900 sq ft of first-floor area)	$3,029,859
Coolers, 3,412,920 cu ft	416,376
Freezers, 246,040 cu ft	34,200
Other facilities:	
Trackage	127,749
Switches	74,256
Rail stops	5,897
Paving	790,660
Sewers (storm and sanitary)	93,793
Street lighting	60,060
Sprinkler system	78,214
Total construction costs of buildings and other facilities	4,711,064
Associated construction costs:	
Architect's fee	235,553
Construction loan	494,662
Contingency allowance	544,128
Total building, other facilities, and associated costs	5,985,407
Multiple-occupancy facilities:	
Buildings (2, totaling 48,000 sq ft of first-floor area)	514,080
Coolers, 666,560 cu ft	81,320
Freezers, 40,680 cu ft	5,655
Other facilities:	
Trackage	21,760
Switches	12,648
Rail stops	1,004
Paving	134,673
Sewers (storm and sanitary)	15,976
Street lighting	10,230
Sprinkler system	14,455
Total construction costs of buildings and other facilities	811,801
Associated construction costs:	
Architect's fee	40,590
Construction loan	85,239
Contingency allowance	93,763
Total building, other facilities, and associated costs	1,031,393

Public Refrigerated Warehouse

Single-occupancy facility:	
Building (57,600 sq ft of first-floor area)	$616,896
Coolers, 448,720 cu ft	54,744
Freezers, 703,280 cu ft	97,756
Other facilities:	
Trackage	25,971
Switches	15,096
Rail stops	1,199
Paving	160,739
Sewers (storm and sanitary)	19,068
Street lighting	12,210
Sprinkler system	1,455
Total construction costs of building and other facilities	1,005,134
Associated construction costs:	
Architect's fee	50,257
Construction loan	105,539
Contingency allowance	116,093
Total building, other facilities, and associated costs	1,277,023

[7] GUIDE TO THE DALLAS AREA "PLANNED INDUSTRIAL DISTRICTS." 44 pp., illus. Dallas Chamber of Commerce. 1972.

The costs of land and facilities are summarized in table 11. However, the cost of the central refrigeration system is not included here because it is assumed that it will be owned by a public cold storage warehouse. For information on the costs of this system, see the appendix under "Estimated Cost of Refrigeration."

TABLE 11.—*Summary of estimated construction and land costs, Dallas, Tex.*

Item	Single-occupancy buildings	Multiple-occupancy buildings	Public refrigerated warehouse	Total
Buildings	$3,480,435	$601,055	$769,396	$4,850,886
Other facilities	1,230,629	210,746	235,738	1,677,113
Associated construction	1,274,343	219,592	271,889	1,765,824
Land	608,100	134,100	152,100	894,300
Total	6,593,507	1,165,493	1,429,123	9,188,123

ESTIMATED ANNUAL COSTS AND REVENUE REQUIREMENTS

The revenue required to operate the proposed facilities could vary according to the methods chosen to finance the center and the rate that will have to be paid for loan capital at the time of construction.

For comparative purposes, four interest rates are given in this report with amortization periods of 25 and 30 years.

It is assumed that the proposed facilities will be privately financed.

It is assumed also that the central energy plant will be owned and operated by a public cold storage warehouse or a utility company; these costs are covered in a separate report (see appendix footnote 1). This assumption is not intended to suggest that this is the most desirable arrangement, nor is it intended to exclude other arrangements; it is used only as a means of estimating probable operation expenses in this report.

The annual costs of operating the proposed facilities include real property taxes, management, insurance, maintenance (and repairs), and debt service. Total annual revenue requirements in this report are based on these five items. They are not intended to be all inclusive, but they provide a realistic basis for computing operating expenses in the proposed facilities.

Real Property Taxes

It has been assumed that new wholesale distribution facilities will pay taxes on land and facilities. Computations were based on an assessed value of 54 percent of total investment in land and facilities. Taxes were computed at $24.75 per $1,000 of assessed value. In addition, a 10-percent reserve fund was included to provide for possible increases in the current tax rate or reassessments. When a full year's tax payment has been accrued, the reserve fund could be discontinued. The total annual tax payment is shown in table 12.

TABLE 12.—*Estimated annual assessed value and income required for real property taxes for proposed wholesale food facilities, Dallas, Tex.*

Type of facility	Assessed value	Income required for—		
		Taxes	Reserve fund	Total
Single occupancy	$3,560,494	$88,122	$8,812	$96,934
Multiple occupancy	629,366	15,577	1,558	17,135
Public refrigerated warehouse	771,726	19,100	1,910	21,010
Total	4,961,586	122,799	12,280	135,079

Management, Insurance, and Maintenance

The operating expenses of the proposed center would include expenditures for management, insurance, and maintenance. These are summarized in table 13 and total $80,057 annually.

Management

The cost for management of a new food distribution center was estimated as follows:

Manager	$12,000
Secretary-clerk (part time)	4,500
Auditing and legal services	2,500
Office rental	1,500
Office supplies	200
Telephone and other communications	500
Total	$21,200

This annual cost of $21,200 is prorated among wholesalers based on the square footage of facilities occupied. Management costs are flexible and depend on the need and services desired by the tenants of the center.

It is assumed that public protection and sanitation expenses, such as street cleaning, would be provided by the municipal government until the market is established. Garbage and trash disposal is the responsibility of individual firms. The market may decide to establish its own solid waste disposal system as it reaches full development.

Insurance

The Property Division Rating Units of the Texas Board of Insurance provided background information concerning estimates for fire and extended coverage insurance, which is computed at approximately $0.040 per 100 based on 80 percent of the proposed cost of the facilities. Liability insurance covering bodily injury and property damage would be approximately $0.136 per 100 square feet of building space for limits of $300,000 per accident. All insurance rates are subject to negotiation at the time of construction.

Maintenance

The annual cost of maintenance was calculated on the basis of three-fourths of 1 percent of the cost of buildings and other facilities. This charge would include both normal preventative maintenance and repair of the center. Maintenance costs were estimated to total $48,961.

Debt Service

The proportion of the total investment cost that might be borrowed on a mortgage loan and the terms of the loan will depend on the availability of money and the interest rates at the time of construction. Since interest rates have been increasing, four rates have been included in this report. The facilities recommended here should not become obsolete nor fully depreciated in less than 20 to 30 years and should have a useful life for a much longer period. Amortization periods are for 25 and 30 years.

A debt service reserve is usually required by creditors. It might be 10 percent of the annual amortization charge and might be discontinued when a full year's amortization charge is accumulated. Such a reserve has been included in the debt service costs.

Table 14 gives the estimated annual income required for debt service to amortize the cost of proposed facilities at four interest rates for 25 and 30 years.

TABLE 13.—*Estimated annual income required for management, insurance, maintenance, and reserve for proposed wholesale food facilities, Dallas, Tex.*

Type of facility	Management	Insurance	Maintenance and repair	Reserve [1]	Total
Single occupancy	$15,264	$1,893	$35,333	$5,249	$57,739
Multiple occupancy	2,544	325	6,089	896	9,854
Public refrigerated warehouse	3,392	400	7,539	1,133	12,464
Total	21,200	2,618	48,961	7,278	80,057

[1] 10 percent of total cost for management, insurance, maintenance, and repairs.

TABLE 14.—*Estimated annual income required for debt service in proposed wholesale food facilities at various interest rates amortized for 25 and 30 years*

Amortization period and interest rates (percent)	Single-occupancy buildings	Multiple-occupancy buildings	Public refrigerated warehouse	Total
Investment in land and facilities	$6,593,507	$1,165,493	$1,429,123	$9,188,123
25 years				
Amortization charge:				
6½	540,536	95,547	117,159	753,242
7½	591,504	104,556	128,207	824,267
8½	644,252	113,880	139,640	897,772
9½	698,648	123,496	151,430	973,574
Reserve:[1]				
6½	54,054	9,555	11,716	75,325
7½	59,150	10,456	12,821	82,427
8½	64,425	11,388	13,964	89,777
9½	69,865	12,350	15,143	97,358
Totals:				
6½	594,590	105,102	128,875	828,567
7½	650,654	115,012	141,028	906,694
8½	708,677	125,268	153,604	987,549
9½	768,513	135,846	166,573	1,070,932
30 years				
Amortization charge:				
6½	504,931	89,253	109,442	703,626
7½	558,272	98,682	121,004	777,958
8½	613,526	108,449	132,980	854,955
9½	670,428	118,507	145,313	934,248
Reserve:[1]				
6½	50,493	8,925	10,944	70,362
7½	55,827	9,868	12,100	77,795
8½	61,353	10,845	13,298	85,496
9½	67,043	11,851	14,531	93,425
Totals:				
6½	555,424	98,178	120,386	773,988
7½	614,099	108,550	133,104	855,753
8½	674,879	119,294	146,278	940,451
9½	737,471	130,358	159,844	1,027,673

[1] 10 percent of amortization charge.

TOTAL ANNUAL REVENUE REQUIRED

The estimated revenue required to finance and operate the proposed new facilities at various interest rates amortized for 25 and 30 years is shown in table 15. Included in these estimates are real property taxes, costs of management and upkeep, and debt service. These costs have been prorated according to the three types of facilities.

SOURCE OF REVENUE

The revenue required to support new facility construction must be obtained from rents or charges for the use of facilities. Rental charges are based on the total annual revenue required.

Average annual rents for the three types of facilities are estimated to range from $2.69 to $3.31 and from $2.55 to $3.20 per square foot assuming a 25- and 30-year amortization period, respectively (table 16). These estimates are based on the first-floor space only.

The estimated annual rentals in proposed facilities, as would be expected, are greater than

TABLE 15.—*Estimated total annual revenue required to own and operate proposed wholesale food facilities at various interest rates amortized for 25 and 30 years*

Amortization period and interest rates (percent)	Single-occupancy buildings	Multiple-occupancy buildings	Public refrigerated warehouse	Total
Real property taxes	$96,934	$17,135	$21,010	$135,079
Management and upkeep	57,739	9,854	12,464	80,057
25 years				
Debt service:				
6½	594,590	105,102	128,875	828,567
7½	650,654	115,012	141,028	906,694
8½	708,677	125,268	153,604	987,549
9½	768,513	135,846	166,573	1,070,932
Totals:				
6½	749,263	132,091	162,349	1,043,703
7½	805,327	142,001	174,502	1,121,830
8½	863,350	152,257	187,078	1,202,685
9½	923,186	162,835	200,047	1,286,068
30 years				
Debt service:				
6½	555,424	98,178	120,386	773,988
7½	614,099	108,550	133,104	855,753
8½	674,879	119,294	146,278	940,451
9½	737,471	130,358	159,844	1,027,673
Totals:				
6½	710,097	125,167	153,860	989,124
7½	768,772	135,539	166,578	1,070,889
8½	829,552	146,283	179,752	1,155,587
9½	892,144	157,347	193,318	1,242,809

TABLE 16.—*Estimated annual per-square-foot rentals required to own and operate proposed wholesale food facilities at various interest rates amortized for 25 and 30 years*

Amortization period and interest rates (percent)	Single-occupancy buildings	Multiple-occupancy buildings	Public refrigerated warehouse	Average [1]
25 year amortization:				
6½	$2.65	$2.75	$2.82	$2.69
7½	2.85	2.96	3.03	2.89
8½	3.05	3.17	3.25	3.10
9½	3.26	3.39	3.47	3.31
30 year amortization:				
6½	2.51	2.61	2.67	2.55
7½	2.72	2.82	2.89	2.76
8½	2.93	3.05	3.12	2.97
9½	3.15	3.28	3.36	3.20

[1] Average total cost based on total annual revenue required divided by total proposed first-floor space.

TABLE 17.—*Estimated annual rents in present and proposed facilities for firms included in new center at various interest rates amortized for 25 and 30 years* [1]

Amortization period and interest rates (percent)	Present rents	Proposed rents	Increase
25 year amortization:			
6½	$601,125	$881,354	$280,229
7½	601,125	947,328	346,203
8½	601,125	1,015,607	414,482
9½	601,125	1,086,021	484,896
30 year amortization:			
6½	601,125	835,264	234,139
7½	601,125	904,311	303,186
8½	601,125	975,835	374,710
9½	601,125	1,049,491	448,366

[1] Costs of public refrigerated warehouse facilities not included.

rentals in existing facilities (table 17). The rentals of proposed buildings are based on the annual revenue previously shown to be required for facilities, and the revenue required would vary according to the financial arrangements. Increased rents are the price that must be paid for reducing specific operating costs and improving working conditions. Rents in the proposed facilities are comparable to rents in modern facilities elsewhere and enable the center to be self-sustaining.

In some wholesale food markets the costs have been reduced or eliminated when some of the required revenue was derived from other sources. For example, railroads may provide the lead-in trackage or switches on site at no additional cost. Utility companies may install lighting in parking areas or provide other services to individual warehouses without charging tie-in or installation fees. Should these or other agencies in Dallas supply these or other services, costs could be reduced.

Also, the present facilities and land have market value. If sold, they could help defray the investment capital requirements for the new facilities and thereby permit rents to be lower. Local estimators place the current market value of the present facilities and land at over one-third the cost of new facilities. If this amount is used to reduce the investment capital requirements, rents would reflect a corresponding decrease of about one-third.

BENEFITS AND CONCLUSIONS

The principal reason for recommending improvements in the Dallas wholesale market is to replace existing facilities, which may be displaced by highway or other urban renewal plans, with modern facilities capable of efficient processing and distribution operations. A new well-planned wholesale food distribution center would have the necessary type, size, and amount of facilities needed by the wholesalers to provide the kind of food handling required for both now and the future.

Estimated savings in the proposed facilities are considered as potential benefits and are based on a comparison of selected marketing costs in existing facilities. These include costs of movement to and distribution from wholesale facilities, handling within the market area, changes in rents, and spoilage and associated costs. The space in the proposed facilities is sufficient to handle the percent volume. Costs for receiving, handling, and distribution are based on the volume in present and proposed facilities. No future growth factors are included in the estimates.

In addition to reducing certain handling and other marketing costs in the proposed facilities, benefits could accrue to the city, farmers, wholesalers, retailers, market employees, transportation firms, and consumers in the area. Rail and

truck operations would be simplified, quality of food would be easier to maintain, sanitation problems would be reduced, the city's tax base and revenues could be increased through better use of the present sites occupied by wholesale food facilities, and the value of land used for and adjoining the new development would increase.

Potential Cost Reductions in Movement to Proposed Wholesale Food Center

Not all the firms needing new facilities can be expected to relocate to one food distribution center. To prevent the disclosure of confidential data and to present a complete picture of the wholesale fruit and vegetable industry, the total volumes and costs of all firms expected to relocate have been included in this analysis. Some of the costs incurred by firms relocating apart from an organized market would be different from the costs of the firms relocating together. These differences are reflected in the volumes and costs outlined in table 18. All present costs are based on information obtained from cooperating wholesalers included in the study.

Table 18 compares the costs of moving food products from the point of initial receipt to wholesalers in present and proposed facilities. The three categories of receipts are (1) direct receipts subject to cartage, (2) direct receipts without cartage, and (3) interdealer transfer. Potential savings in movement to proposed facilities total $26,171 annually.

For this analysis, cartage is the process by which a wholesaler moves incoming products from some point in the city to his wholesale facilities. The costs associated with cartage include labor for truck loading and unloading as well as vehicle and driver time. Existing cartage consists almost exclusively of rail receipts moved by truck from team tracks to wholesale facilities.

The master plan provides for direct rail service, which will reduce the already minimal cartage from railcars on team tracks to wholesalers' facilities. Other types of cartage, such as fresh fruits and vegetables received by air, were found to be negligible. For the full savings to be realized in new facilities, working agreements must be obtained among inbound rail carriers. These agreements will permit the carriers to switch to house tracks at no additional charge. Additional expenses would be incurred if switching were not completed within a reasonable time after the scheduled arrival of trains in the city. Working agreements must be reached during negotiations for land. Costs resulting from failure to obtain these agreements have not been added to the cartage costs.

The costs of direct receipts are not directly borne by the wholesaler. For this reason, these costs were not included in the analysis.

Interdealer transfer consists of the physical movement of products between two or more of the wholesalers included in this study. The costs associated with this function include the cost of truck unloading and vehicle and driver cost. Labor costs associated with interdealer transfer would be expected to be reduced in new facilities. Present transfers, although not excessive, include trips within the city. In the proposed center, movement between wholesalers located together in a common market would mean shorter travel distances over street isolated from outside traffic.

Potential Cost Reductions in Handling Within Proposed Wholesale Food Center

Substantial savings in operating costs are possible in new facilities. Table 19 summarizes the

TABLE 18.—*Estimated selected costs of moving food commodities to present and proposed facilities of independent fresh fruit and vegetable wholesalers, Dallas, Tex., 1972*

Item	Volume	Present facilities		Proposed facilities		Difference
		Cost per ton	Total cost	Cost per ton	Total cost	
	Tons					
Direct receipts subject to cartage	834	$11.48	$9,574	0	0	$9,574
Direct receipts without cartage	398,318	-----	------	----	------	------
Interdealer transfer	9,938	8.11	80,597	$6.44	$64,000	16,597
Total or average	409,090	.22	90,171	.16	64,000	26,171

TABLE 19.—*Estimated selected costs of moving food commodities through present and proposed facilities of independent fresh fruit and vegetable wholesalers, Dallas, Tex., 1972* [1]

Item	Present facilities		Proposed facilities		Difference
	Cost per ton	Total cost	Cost per ton	Total cost	
Facility labor:					
Receiving	$0.52	$212,727	$0.22	$90,000	$122,727
Assembly and loading out	1.85	756,816	.92	376,363	380,453
Handling equipment	.25	102,273	.27	110,454	[2] −8,181
Waste, theft, and deterioration	1.36	556,362	1.30	531,817	24,545
Total or average	3.98	1,628,178	2.71	1,108,634	519,544

[1] Costs based on an annual volume of 409,090 tons.

[2] Minus sign designates cost increase.

relative costs of operating within the present and proposed wholesale facilities excluding the rent. This table indicates a potential annual savings in handling costs of $519,544.

The handling costs in present facilities are based on information supplied by cooperating wholesalers. Costs for labor in the proposed facilities are based on published research conducted by the Department.[8] In table 19, receiving consists of truck and railcar unloading, palletizing, and movement to storage performed by wholesalers' employees. The unloading assistance performed by drivers of suppliers' trucks was not included.

Handling equipment requirements in new facilities are based on estimates of actual equipment needs of individual firms and information from a Department publication.[9] Cost of waste, theft, and deterioration in new facilities was estimated at 1 percent of the total annual volume, based on the experience of fresh fruit and vegetable wholesalers in modern facilities with adequate refrigeration.

The greatest potential savings within the wholesale facilities is in the reduced cost of labor required for materials handling in receiving, assembly, and loading out. A high level of labor efficiency can be realized by using mechanized equipment and proper layouts and techniques in single-level buildings with proper rail and truck receiving and loading areas. Suggestions for the proper use of modern wholesale facilities are included in the appendix under "Guides to Planning and Operating Efficiently in New Facilities."

Assuming efficient methods and properly designed facilities, wholesalers should be able to reduce their labor costs in the new buildings from their present labor costs. This savings would be partly offset by increased charges for additional materials-handling equipment.

Additional savings are possible by reducing waste, theft, and deterioration with proper storage conditions and improved handling practices expected in new facilities. Combined storage and improved access to produce result in better inventory control and lessen the opportunity for theft. Wholesalers should be able to reduce waste, theft, and deterioration costs in new facilities.

[8] BOGARDUS, R. K., and BURT, S. W. LOADING OUT FRUITS AND VEGETABLES IN WHOLESALE WAREHOUSES. U.S. Dept. Agr. Agr. Mktg. Res. Rpt. 282, 53 pp. 1959.

BOGARDUS, R. K., and FERRIS, R. T. RECEIVING FRUITS AND VEGETABLES IN WHOLESALE WAREHOUSES. U.S. Dept. Agr. Agr. Mktg. Res. Rpt. 478, 45 pp. 1961.

FERRIS, R. T., and BOGARDUS, R. K. STORING FRUITS AND VEGETABLES ON PALLETS IN WHOLESALE WAREHOUSES. U.S. Dept. Agr. Agr. Mktg. Res. Rpt. 622, 39 pp. 1964.

VOLZ, M. D., and KARITAS, J. J. HANDLING AND SPACE COSTS FOR SELECTED FOOD WHOLESALERS IN URBAN FOOD DISTRIBUTION CENTERS. U.S. Dept. Agr. Agr. Res. Rpt. 992, 24 pp. 1973.

[9] See footnote 8, last reference.

Potential Cost Reductions in Distribution From Proposed Wholesale Food Center

Distribution costs will depend on the site chosen for the new food distribution center and the relationship between its location and that of the center's customers. To investigate this relationship, Dallas was divided into five areas (fig. 3). Area 1 is the downtown center of the city bounded by loop 12, and areas 2, 3, 4, and 5 are the northeast, northwest, southwest, and southeast quarters of the city bounded by loop 12 and extending to or just beyond the Belt Line Road.

Table 20 summarizes the estimated costs of distributing the same volume of products from facilities within the five areas to alternative sites in these areas. Savings are the difference between the distribution costs of the present and the proposed facilities. Distribution costs from proposed facilities in area 1 are assumed to be equal to those from present facilities. These costs are approximate and are not dependent on any particular site; they should be used only as a general guide. The methodology used to develop them is given in the appendix under "Calculating Distribution Costs."

Products are distributed by the wholesalers to each of the five areas. Area 1, the present market location, receives over 61 percent of the products distributed within the study area; area 3, 21 percent; area 2, 10 percent; area 4, 7 percent; and area 5, approximately 1 percent. In addition to the 161,330 tons distributed within the study area, an additional 90,674 tons were picked up by wholesalers' customers and 147,148 tons were distributed outside the study area.

Not all the firms needing new facilities are expected to relocate together. For this report and to prevent the disclosure of confidential data, this table is based on the assumption that all the firms will locate within the same distribution area. Relocating to different sites within the same distribution area should not affect the costs of distribution to any great degree.

TABLE 20.—*Estimated selected costs of moving food products from facilities of independent fresh fruit and vegetable wholesalers in 5 areas to alternative sites in these areas, Dallas, Tex.*[1]

Facility in area—	Cost of moving indicated volume (tons) to sites in—				
	Area 1 (99,702)	Area 2 (16,133)	Area 3 (33,073)	Area 4 (11,938)	Area 5 (484)
	COST PER TON				
1	$6.96	$7.59	$8.03	$7.86	$7.75
2	8.36	6.63	8.26	9.92	8.59
3	8.03	8.26	6.52	8.70	10.58
4	7.86	9.92	8.91	6.67	8.51
5	7.74	8.58	10.66	8.50	6.60
Average	7.39	7.80	7.82	8.15	8.47
	TOTAL COSTS				
1	693,926	756,738	800,607	783,658	772,690
2	134,872	106,962	133,259	160,039	138,582
3	265,576	273,183	215,636	287,735	349,912
4	93,833	118,425	106,367	79,626	101,592
5	3,746	4,153	5,159	4,114	3,194
Total	1,191,953	1,259,461	1,261,028	1,315,172	1,365,970
	SAVINGS				
1	0	−62,812	−106,681	−89,732	−78,764
2	0	27,910	1,613	−25,167	3,710
3	0	−7,607	49,940	22,159	−84,336
4	0	−24,592	−12,534	14,207	−7,759
5	0	−407	−1,413	−368	552
Total	0	−67,508	−69,075	−123,219	−174,017

[1] Present market is in area A. Minus signs designate cost increase. Average and totals based on volume of 161,330 tons.

Keeping the market within area 1, its present location, would minimize changes in distribution costs. Because of the great volume of products moving to area 1, relocating the wholesale facilities to sites in areas 2, 3, 4, or 5 would increase the annual distribution costs above present levels. Relocating the market within area 2 or 3 would minimize this increase compared with considerable increases in distribution costs from relocating to area 4 or 5.

Costs to customers of picking up products at the wholesale facility were not included in this analysis as they were not borne directly by the wholesalers. Costs of distributing outside the study area were not developed as they are beyond the scope of this report.

APPENDIX

Types of Ownership

Private Corporation

A private corporation, organized to own and operate a wholesale food center, is a legal entity. It is organized in conformity with State statutes and made up of individuals bound together for a common purpose or objective. Usually a private corporation is operated on a profit basis, but it may also be a nonprofit operation.

When a private corporation is operated for profit, there are usually no restrictions on the sale of voting stock to any individual because of his occupation or profession nor on the number of shares of voting stock that may be held by any one individual. Stockholders have one vote in corporate affairs for each share of voting stock held. Some wholesale food markets are owned and operated by private corporations. The principal stockholders in some of these corporations are the tenants. In others, the corporation is a rail company or other firm that was primarily organized for another type of business. Most of the large terminal produce markets built in the 1920's were sponsored by rail companies.

To form a private corporation, the incorporators usually obtain a charter from the State. This charter defines the powers of the corporation and of its officers and directors. It specifies the stockholders' rights and how control shall be exercised.

Among the characteristics of a private corporation is the power of the board of directors to make decisions quickly and without the delay found in some other types of organization. Often this executive authority is exercised through the immediate management. Quick decisions on major policy matters may be the difference between success and failure of the organization. In addition, when the period of amortization expires, the entire investment belongs to the stockholders, tenancy changes have no effect on stock ownership, and transfer of stock is unrestricted.

A nonprofit private corporation is not a government agency but must be organized in conformity with existing State statutes. In a nonprofit corporation, participation in corporate rights and activities is usually based either on a system of dues, which limits each member (stockholder) to one vote, or on bylaws, which restrict ownership of voting stock to one share per member. As a rule, State statutes place no limitations on participation in the corporation of any individual because of his occupation or profession. However, membership in such corporations can usually be limited or restricted through bylaws. Thus, those who are directly interested in the ownership and operation of a wholesale center can form a nonprofit private corporation to construct and operate the market. An example of such a corporation is the small business investment company set up under the U.S. Small Business Administration.

The Congress in 1958 passed the Small Business Investment Act, which established a program to stimulate the flow of private equity capital and long term loans for the sound financing of the operations, growth, expansion, and modernization of small business concerns. Under this Act the Small Business Administration is authorized to make loans to so-called "State development companies" or to local development companies, and license, regulate, and give financial assistance to privately organized, privately financed companies called "small business investment companies."

A development company may be either a profit or nonprofit enterprise incorporated under State law, with authority to promote and assist the growth and development of small businesses in specific areas. A State development company is a corporation organized under a special legislative

act to operate statewide. A local development company is a corporation with a broad base of ownership, formed under applicable State laws, to further the economic development of its communities.

The Small Business Administration is authorized to make loans to State and local development companies in exchange for obligations of the development company. It is also authorized to make loans for construction, conversion, or expansion of plants and for the acquisition of land. Such loans may be made either directly or in cooperation with banks or other lending institutions. Certain rules and regulations have been set up defining eligible business categories and needed collateral.

Public Benefit Corporation

Public benefit corporations, sometimes called "market authorities," offer some desirable features not found in other types of ownership. They differ from nonprofit corporations only in that they are publicly owned.

A public benefit corporation is a nonprofit agency. Rentals and other charges do not exceed the amount needed to pay the costs of operation, to amortize the original investment, and to maintain a limited contingency fund. Under public ownership the revenues would be considered as public funds and as such could not be paid to lessees as dividends. However, these funds might possibly be appropriated for other public uses while they remained outstanding, unless they were specifically committed to redemption of bonds.

Public benefit corporations usually have the power of eminent domain, which can be useful in the acquisition of a site. Such corporations usually finance market improvements through the sale of revenue bonds. This type of financing normally is not a full obligation of a State or a political subdivision. Since these revenue bonds are often tax exempt, the interest cost is lower. A public agency, such as a market authority, is more likely than some types of private ownership to provide for future expansion and to work toward the establishment of a complete wholesale food distribution center. A market authority may or may not be required to pay taxes to the community in which it is located.

Market authorities have certain limitations, especially in the financing and operation of the facilities. They have difficulty in raising funds through revenue bonds unless considerable equity funds are provided in some way or the bonds are guaranteed by the city, county, or State. Some State or city governments have appropriated part of the funds needed for land acquisition and original construction. The continuity of management may be dependent on the continuance of a State or municipal government administration in office. Generally market authorities do not have as complete freedom of operation as is possible under private ownership.

Direct Public Ownership

Many wholesale food distribution centers have been financed, constructed, and operated by States, counties, or municipalities. Several States and some municipalities have enabling legislation covering the improvement or establishment of produce markets.

Direct State ownership and operation usually can be differentiated from ownership and operation by a State market authority by the methods of financing used and the delegation of authority made by the State legislature. Although some States have appropriated funds and otherwise assisted market authorities with financial problems, they do not usually underwrite the total cost of a market constructed by an authority nor have the States always assumed responsibility for the operation of these markets.

Under direct State ownership a market facility is financed in whole or in part by an appropriation of State funds. If the financing is not entirely by this method, the State usually is obligated for the remainder unless this balance is obtained through grants or donations. Also, the State is responsible for maintenance and other expenses involved in the operation of a State-owned market.

States may finance, construct, and operate wholesale food market facilities because of enabling legislation. Several State legislatures consider that improved facilities will in themselves serve the public interest.

Municipal ownership of a wholesale food distribution center is comparable in many of its basic aspects to direct State ownership. Some

municipalities are authorized in their charters to construct and operate food markets. However, some city councils or commissions are not authorized to make appropriations from general funds in the city treasury for the construction of market facilities. Methods usually open to municipalities for financing a market program are (1) issuing municipal bonds, (2) issuing revenue warrants, and (3) obtaining loans from public corporations. In most cities, issuing bonds for such purposes must be approved by a majority of the qualified voters in a referendum.

Facilities constructed with municipal or county funds would necessarily be owned by the municipality or county, and rent would have to be paid by the tenants as long as the municipality or county continues to own the facilities.

Combinations of Financing

Because of the complexity of building large wholesale food distribution centers, some are financed by a combination of private and public funds. Construction of a food distribution center in the Northeast typifies the possibilities of various combinations of financing.

In Philadelphia the food distribution center was built partly by a nonprofit corporation and partly by private owners on land owned and put into condition for building by the city. The city subordinated its interest in the land so that the land could be used as equity in borrowing money for building construction. When the multiple-occupancy facilities were built, the development company leased the facilities to operating stock companies formed by the prospective tenants. At the end of 30 years all land and facilities will become the property of the city, except the parcels of land sold by the development company with the city's approval for construction of single-occupancy buildings.

Construction Costs

Building construction costs for this study were estimated from 1973 construction cost information and indexes. Steel and masonry construction was assumed. Local architects and engineers also provided construction cost information.

Basic buildings costs averaged $10.71 per square foot of first-floor space. This cost includes charges for overhead mezzanines used for offices and other support activities required for firms in both single-occupancy and multiple-occupancy buildings. Freezer and cooler space cost $0.139 and $0.122 per cubic foot, respectively, in addition to the basic building costs.

Costs of other facilities, except where noted, were developed from the same sources used to obtain building construction costs. These other facilities costs are as follows:

Trackage.—House and lead-in tracks are estimated at $21.40 per linear foot. Estimates include a prorated share of lead-in tracks to the user. Railroad switches are estimated at $6,000 per switch. Rail stops are estimated at $450 each. The cost of track, switches, and stops are based on recent construction in the Dallas area and confirmed by local rail agencies serving the area.

Paving.—Asphalt paving is estimated at $5.95 per square yard. Estimates include the allocated share of streets and parking areas. Paving specifications should conform to local codes and those established by the Asphalt Institute.

Sewers.—Fifteen-inch storm sewers are estimated at $8.25 per linear foot and 12-inch sanitary sewers at $5.35 per linear foot. Sewer costs are computed on a prorated basis for the amount of facilities being served.

Street Lights.—Street lights are estimated at $1,500 each, completely installed.

Sprinkler System.—The cost of the sprinkler system is estimated at $0.65 per square foot for nonrefrigerated areas only. Total costs are based on unrefrigerated space on both first floors and mezzanines. A total of 120,329 square feet of unrefrigerated space is equipped with sprinklers in the single-occupancy buildings. Equivalent space in the multiple-occupancy buildings totals 12,638 square feet and 2,238 square feet in the public refrigerated warehouse. Of the total nonrefrigerated space, 32,215 square feet are used for offices.

Fees.—Associated construction costs are estimated as follows: Architect's fee, 5 percent of building and facilities cost; construction loan, 10 percent of building and facilities cost and architect's fee; and contingency allowance, 10 percent of building and facilities cost, architect's fee, and construction loan. The contingency allowance may be discontinued when a sufficient reserve has been acquired. These fees are based on prevailing charges in the Dallas area.

Estimated Cost of Refrigeration

A separate study was conducted by private contract to determine the requirements of a central plant to supply refrigeration service to occupants of the proposed food distribution center for Dallas.[1] The cost of such a system with the capacity to supply 1,272 tons of refrigeration at peak requirements was estimated at $2.1 million. The annual cost of owning and operating the central refrigeration system and terminal equipment is estimated at $703,100 or $553 per ton. This cost includes expenses for financing, plant payroll, refrigerant, and maintenance and repairs.

During the first 10 years of operations, the cost to a hypothetical firm for using refrigeration from a central plant would be approximately 62 percent of the cost for owning and operating its own refrigeration equipment. An additional advantage to the firm would be not having to supply the initial capital required for installing its own equipment. Also, the investment required for a central refrigeration system is 76 percent of the aggregate cost that would be required for each firm to supply its own system. An analysis to determine if two central refrigeration systems might be more economical than one revealed that one system would require only 61 percent of the investment required for two systems.

A central refrigeration system offers other than economic advantages. A central plant can provide backup services and relieve the individual food wholesaler of the problems of adding more equipment when existing services become overloaded. Furthermore, a central plant relieves the wholesalers of the responsibility for day-to-day maintenance and repairs.

A cost of refrigeration to the user, not included in the cost of the central plant, is the initial investment in cooler and freezer space. This expense is included in the estimated investment costs.

For this study it is assumed the central refrigeration system will be owned by a public cold storage warehouse. Actual charges to firms using refrigeration from the central plant would be determined by assessing a flat charge for each terminal evaporator and by metering the demand for refrigerants to each room.

[1] Food Industry Services. central refrigeration system for a proposed food distribution center in dallas, texas. U.S. Dept. Agr. ARS–NE–27, 24 pp., illus. 1973.

Guides to Planning and Operating Efficiently in New Facilities

Two principles should be considered by wholesalers who are planning to move to new facilities. The first is to make the most efficient use of available labor. Each operation of unloading, moving into the facility, processing, packaging, assembling, and loading into delivery trucks must be well planned before the wholesaler moves to his new building. After starting operations in new facilities, the wholesaler should periodically reevaluate each operation to assure that he still has the most efficient combination of labor and equipment needed to perform the work at hand.

The second principle is for the wholesaler to make the best use of his new facility. Making full use of the storage cube with racks to hold the pallets of merchandise in tiers saves valuable space. Items with the most rapid turnover should be where they will have to be moved the shortest practicable distance. Large open areas with a minimum of obstructions provide flexibility. Handling systems designed to minimize the number of times products are handled and the distance they are transported reduce the possibility of physical damage to a wholesaler's inventory. All these points should be considered in planning how to make the best use of a new building.

Calculating Distribution Costs

To compare the impact of relocating the market, present distribution costs were calculated and compared with estimated equivalent costs based on relocating the market in different areas of the city. For this report the city was divided into area 1 (central), area 2 (northeast), area 3 (northwest), area 4 (southwest), and area 5 (southeast), as shown in figure 3.

Distribution costs were calculated based on the volume movement to each of these areas. Volume movement to all areas was based on the direct receipts available for delivery by the wholesalers to customers within the metropolitan area.

Basic data on costs relating to distribution were obtained from a representative sample of firms associated with this study. Unless otherwise noted, all references to cost and produce movement relate to these sample firms.

Information from the sample firms was used to calculate overall truck ownership and operating

costs and total labor delivery costs. They were calculated for each firm in the cost sample. To obtain a common basis of calculation, all trucks were assumed to depreciate over a 6-year period on a straight-line basis with no scrap value. Six-percent simple interest was charged for one-half of the initial purchase price to determine annual interest costs. Actual insurance costs were obtained and utilized. Operating costs consisted of actual charges for gas, oil, and maintenance. Labor costs were calculated by applying the actual wage rates, including fringe benefits, to the employee time spent on delivery activities.

Total truck costs, including ownership and operating charges, and labor costs were converted to a form suitable for subsequent calculations. Truck costs were divided by the total miles driven to determine an average per mile cost for each firm. Similarly the total labor costs of delivery operations were divided by the time in minutes spent on delivery to calculate an average labor cost per minute for each firm. This information was applied to the time-distance chart shown in table 21 to determine the round-trip cost per ton to each area. This partial distribution round-trip cost per ton represented only the cost of on the road movement to each area.

The round-trip cost per ton to each area was calculated as follows:

$$\text{Round-trip cost per ton} = \frac{[(\text{annual round-trip time in minutes})(\text{labor cost per minute}) + (\text{annual round-trip miles})(\text{truck cost per mile})]}{\text{annual tons distributed to each area}}$$

Where

$$\text{Number of trips} = \frac{\text{annual tons distributed to each area}}{\text{average tons per truckload}}$$

and

$$\text{Total round-trip time} = (\text{number of trips to each area})(\text{minutes per trip})^{2}$$

and

$$\text{Total round-trip miles} = (\text{number of trips to each area})(\text{miles per trip})^{2}$$

TABLE 21.—*Distance and time per round trip between centers of 5 Dallas distribution areas* [1]

Distance and time from—	Area 1 (central)	Area 2 (northeast)	Area 3 (northwest)	Area 4 (southwest)	Area 5 (southeast)
Area 1:					
Miles	8.7				
Minutes	20.9				
Area 2:					
Miles	14.5	5.7			
Minutes	34.8	13.7			
Area 3:					
Miles	18.6	20.7	4.7		
Minutes	44.6	49.6	11.3		
Area 4:					
Miles	17.0	36.0	24.7	6.1	
Minutes	40.8	86.3	59.2	14.6	
Area 5:					
Miles	16.0	23.7	43.0	23.0	5.5
Minutes	38.4	56.8	103.1	55.2	13.2

[1] Travel within area based on ½ average round-trip distance from center to perimeter. Time based on average speed of 25 mi/h.

[2] See table 21.

An average round-trip cost per ton was calculated for all the firms by multiplying each firm's round-trip cost per ton to each area by the volume that firm distributed to that area, totaling the products, and dividing the result by the total tonnage all the firms distributed to that area. This average round-trip cost is defined as the to-from cost per ton. A different to-from cost was calculated for each of the five areas.

The next step in the analysis was to calculate the remaining part of the distribution cost, which consisted of expenses for unloading at the customers' facilities, movement between customers, and associated delays. This part of the delivery cost was assumed to remain constant regardless of the location of the wholesalers in relationship to their customers and is defined as the base cost. The base cost was calculated as follows:

$$\text{Base cost per ton} = (\text{total delivery cost per ton}) - (\text{overall round-trip cost per ton})$$

Where

$$\text{Total base cost per ton} = \frac{[(\text{total truck operating and ownership cost for all firms}) + (\text{total labor cost for delivery by same firms})]}{\text{total tons delivered within 5 areas}}$$

and

$$\text{Overall round-trip cost per ton} = \frac{\begin{aligned}[&(\text{tonnage delivered to area 1})(\text{to-from cost per ton to area 1}) + \\ &(\text{tonnage delivered to area 2})(\text{to-from cost per ton to area 2}) + \\ &(\text{tonnage delivered to area 3})(\text{to-from cost per ton to area 3}) + \\ &(\text{tonnage delivered to area 4})(\text{to-from cost per ton to area 4}) + \\ &(\text{tonnage delivered to area 5})(\text{to-from cost per ton to area 5})]\end{aligned}}{\text{total tons delivered within 5 areas}}$$

The calculations result in one base cost per ton that can be applied to each of the five areas. This cost was then added to the to-from cost per ton for each area. The result is defined as the distribution cost per ton. A different distribution cost per ton results for each area, reflecting the effect of market relocation from one area to another.

The distribution costs per ton for each area developed for the sample firms were then applied to the volume distributed by all the firms to each area. The resulting distribution costs are shown in table 20.

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